

SPRING 2009

from the California Academy of Sciences

LIVE

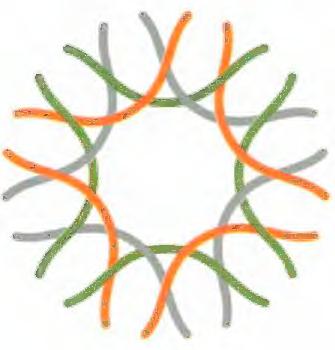
Swoop In:

DNA data helps birds

Wildlife photos on display

Spring calendar of events

Sustainability tips



CALIFORNIA ACADEMY OF SCIENCES

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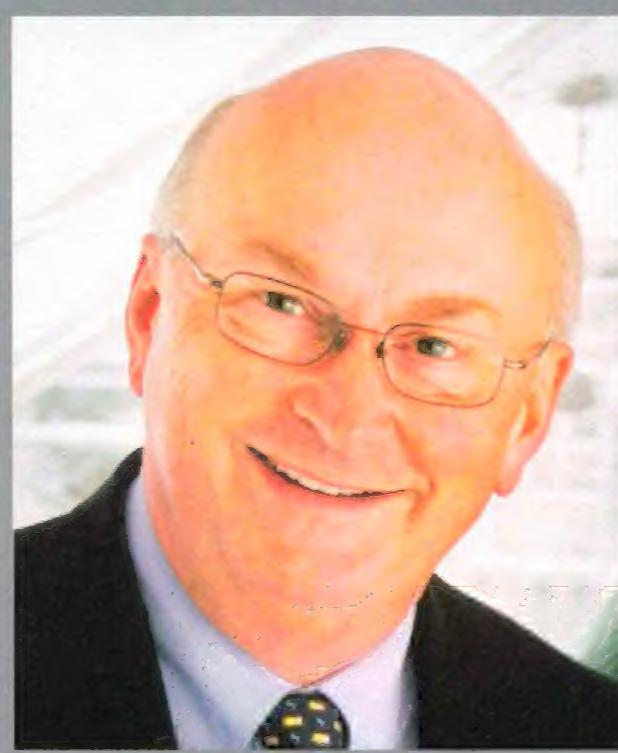
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The annual gift of spring is a gift of hope, new growth, and fresh starts—which this year includes a new administration in Washington.

Of course, this spring comes at a time of uncertainty in the world around us.

However, as I sit here at the Academy, surrounded by evidence that life survives by adapting to change, in a building full of scientists who are attacking some of the most critical questions of our time, not to mention hundreds of kids who are rushing from one “wow” moment to another, I am resolutely optimistic.

This is not to say that we don't have our work cut out for us. The Academy recently commissioned a national scientific literacy poll to evaluate how knowledgeable American adults are about basic scientific concepts. Only 53% of respondents knew how long it takes the Earth to revolve around the Sun. Only 47% could correctly approximate the percent of the planet that is covered by water. (You can take the poll yourself on the Academy's website, and you never have to reveal your score!)

Improving basic scientific literacy is a first step toward deepening our understanding of the world around us—and strengthening our economy along the way. As Academy members, you are supporting our efforts to achieve these goals, as we strive to make science exciting and accessible—and full of “wows”—for hundreds of thousands of visitors.

A handwritten signature in black ink that reads "Greg Farrington".

Greg Farrington
Executive Director

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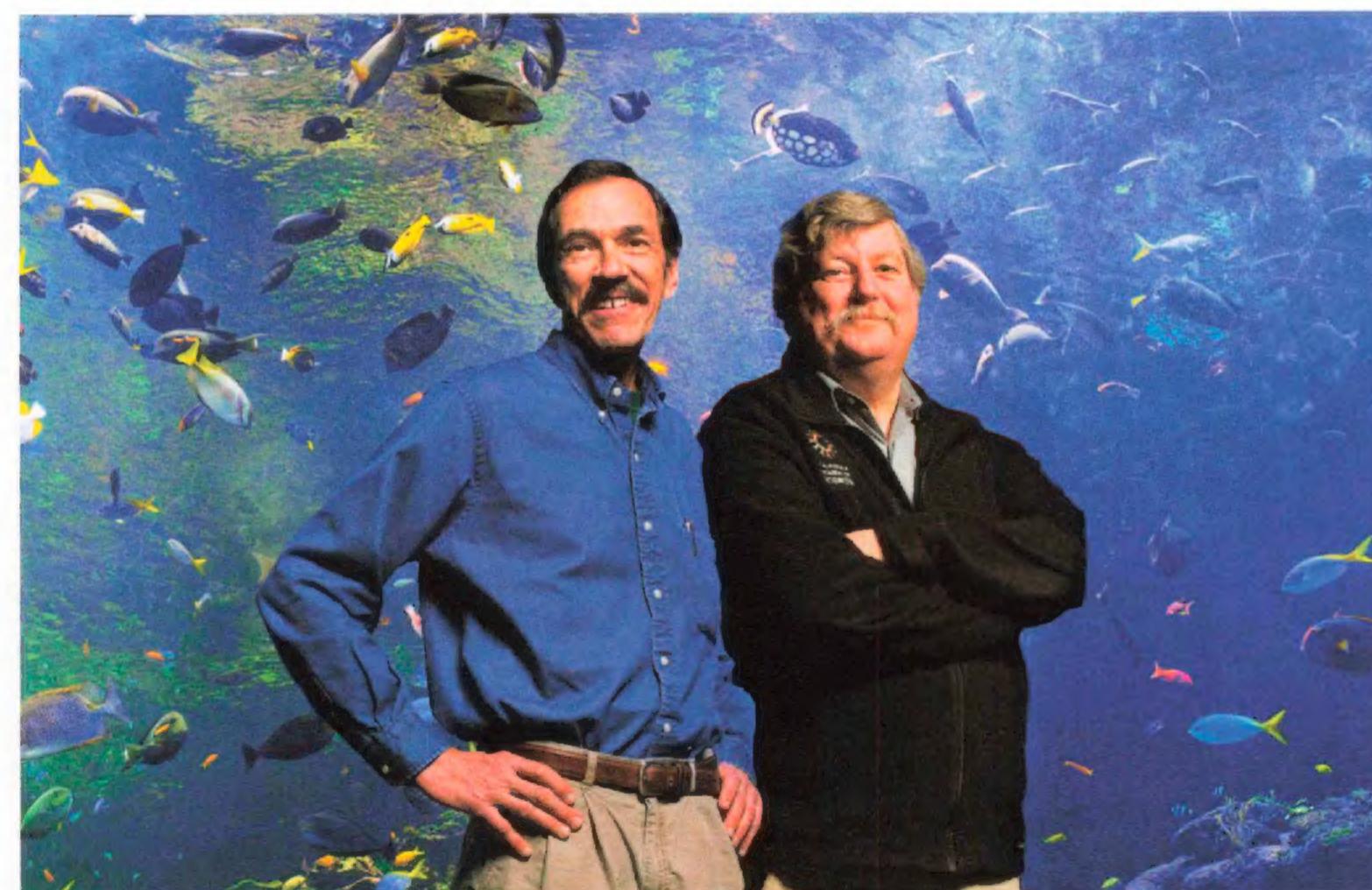


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On the Cover



A male Snowy Owl stretches his wings and flares his talons in pursuit of a mouse under Canadian snow. The Arctic plays a major role in regulating global climate, and evidence suggests that climate changes are already impacting natural environments there. This image is part of the new photo exhibit and book, *A Climate for Life*, now on display at the Academy. Learn more on page 13. Cover photo by Vincent Munier.

Canadian snow. The Arctic plays a major role in regulating global climate, and evidence suggests that climate changes are already impacting natural environments there. This image is part of the new photo exhibit and book, *A Climate for Life*, now on display at the Academy. Learn more on page 13. Cover photo by Vincent Munier.

On the Back

The Academy's upside-down jellyfish are now the proud parents of dozens of upside-down offspring.



Where in the World

The ghost pipefish lives in the shallow tropical waters of the Indo-Pacific, near coral reef habitats. It swims vertically among beds of seagrass, using its body shape and greenish color to camouflage itself.



Academy Collection

In addition to the recent New Caledonia specimen, the Academy has two other *Solenostomus cyanopterus* specimens in its ichthyology collection. They were both collected in Japan—one in 1900, and the other on an unknown date. The Academy has five additional specimens from the same genus, collected from Australia, Japan, and the Philippines between 1931 and 1981.

Diet

The ghost pipefish stares downward in search of tiny shrimp and other zooplankton. Like a seahorse, its jaws are fused together and act like a straw to suck up prey. Its well-camouflaged appearance helps it sneak up on unsuspecting victims.

Additional Finds in New Caledonia

On the same day that Hamilton's team found the *S. cyanopterus* specimen, they also found a pygmy pipehorse (*Acentronura breviperula*), one of the other rare target species they were looking for. And earlier in the expedition, they came across a pleasant surprise—a juvenile specimen of what they believed to be a thorny seahorse (*Hippocampus histrix*). Prior to this discovery, the waters of New Caledonia had not been considered part of this species' range.

Ghost Pipefish



Bargaining with local chiefs, sailing through rough seas, and diving on the world's second longest barrier reef—a team of Academy researchers did it all during an expedition to New Caledonia. In October 2008, scientists Healy Hamilton, Graham Short, and David McGuire plied the waters of this south Pacific island—an overseas territory of France—in search of several rare fish species that could provide insight into the evolution of seahorses and their relatives. While they found many important specimens after three weeks of methodical searching, their rare target species proved elusive—that is, until the very last day of their expedition.

On that fateful day, Short was swimming toward a purple sponge on the seafloor when a ghost pipefish (*Solenostomus cyanopterus*) suddenly appeared in front of his mask. It was one of the species they had been desperately trying to find. Short got down on his knees and waved his arms, and his colleagues quickly joined him to document and collect the well-camouflaged specimen before it disappeared into the seagrass.

This ghost pipefish specimen, which now resides in the Academy's collection, is one of only a few in the world that can be used for DNA research. Almost every previous specimen has been preserved in formalin, which degrades DNA. Because the ghost pipefish represents a closely related but ancestral lineage to the syngnathids—the family of fish that includes seahorses, seadragons, pipehorses, and other pipefish—the genetic information gleaned from this one specimen will vastly improve the understanding of how the syngnathids evolved. Scientists can then use this knowledge to determine conservation priorities and protect the biodiversity of these charismatic, but threatened, creatures.



Kuhl's Flying Gecko

Leaping lizards, flying frogs, soaring squirrels—the forests of Borneo are home to a whole host of gravity-defying creatures. In fact, more than 30 different species of airborne amphibians, reptiles, and mammals can be found gliding through the rainforests of this Indonesian island. By comparison, Central America hosts just two gliding species, none are found in the Amazon, and Africa is home to merely a handful. What's in the air in Borneo? Many scientists believe that gliding is a particularly useful adaptation on this island because the canopy trees are taller and farther apart—with fewer connecting vines—than in rainforests in other parts of the world. To get from one tree to the next, animals can either take the long route by climbing down, over, and up, or they can opt for the shortcut by going airborne.

While they can't actually fly like bats or birds, Borneo's gliders are often accomplished aerial acrobats, steering controlled flight paths through the forest canopy and deftly avoiding crash landings. One such species is Kuhl's flying gecko (*Ptychozoon kuhli*), a tree-dwelling animal that can jump from great heights to escape predators or move to new feeding grounds. As it falls, the gecko assumes a spread-eagle position, and folded flaps of skin along its sides flare out like a parachute to slow its descent. Smaller skin flaps along its limbs and jaws, around its tail, and between its toes create additional surface area—and additional wind resistance—throughout the journey. By subtly shifting its body weight or adjusting its tail, the gecko can steer a precise course as it parachutes down, even changing direction by up to 180 degrees.



Where in the World

Kuhl's flying gecko is widespread in Southeast Asia, ranging from the Malayan Peninsula, through Sumatra and Java, to Borneo and adjacent islands. It spends most of its time in the trees, where it preys on small insects.

Where in the Academy

These flying geckos can be found in the Borneo level of the Academy's Rainforests of the World exhibit, along with another gliding species from Borneo—Reinwart's flying frog. They tend to congregate near the top of a tree stump in their tank, where they can keep an eye on the other inhabitants of the exhibit.

Double Duty Adaptation

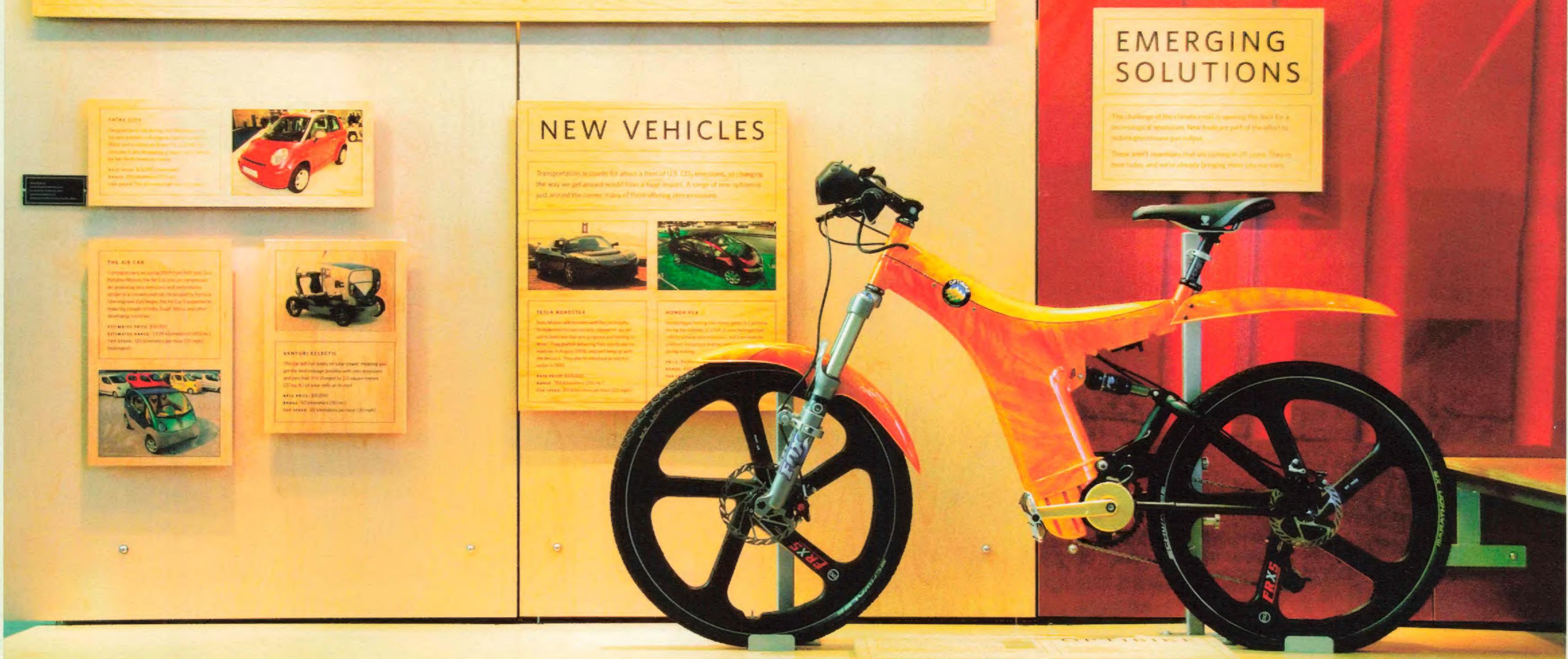
The flaps of skin that help these geckos glide also keep them camouflaged as they rest against a tree trunk, breaking up the outline of their bodies. Scientists believe that these skin flaps first evolved as a method of disguise, then became exaggerated as their parachuting properties became useful.

Sticking Power

Like other geckos, the Kuhl's flying gecko is an excellent climber, thanks to billions of tiny filaments on its toe pads. These filaments are so small that an attraction is able to form between the atoms in the gecko's toes and the atoms in the surface of the rock, tree, or other surface it is climbing.



DREAMING UP SOLUTIONS



Sustainability Made Simple

A new pocket-sized guide offers dozens of eco-friendly tips

ARMED WITH information and a desire to protect the planet, anyone can lead a more sustainable life. To that end, the Academy has produced a pocket-sized *Sustainability Made Simple* guide, offering dozens of eco-friendly tips that people can use to green their lives.

Organized into the broad themes of transportation, food, and home practices, each suggestion consists of three steps that progress from the simplest to the most complex.

Driving Habits

People need to go places, but there are changes you can make to reduce your global warming emissions when traveling.

Step 1 Conserve gas by driving the speed limit.

Step 2 Turn off your engine rather than idling when you are still for more than a few minutes.

Step 3 Open your windows when going slowly; close your windows and switch on the A/C when on the freeway.

The guide's Getting Around section has more tips about vehicle maintenance, choosing your mode of transportation, and out-of-town travel.

Shopping

What you choose to eat and drink affects both your health and the environment, so choose carefully.

Step 1 Cut down on processed foods.

Step 2 Look for local, seasonal, organic foods.

Step 3 Subscribe to a

Community Supported Agriculture (CSA) program—CSA members receive regular baskets of organic produce from a local farmer, in return for helping to fund the farm.

Find tips on seafood choices, meat and dairy choices, and dining out in the On the Menu section.

Heating and Cooling

The choices you make around your home have significant impact on the natural world. You can make changes to lower that impact.

Step 1 Keep your thermostat at 78°F in the summer and 68°F in the winter.

Step 2 Turn down heat or air conditioning when you are sleeping or not at home.

Step 3 Install a

programmable thermostat to ensure your home's temperature is optimal for your comfort and for the environment.

In the At Home section, find out how to green your energy use, waste, lighting, insulation, electronics and appliances, water usage, and purchasing.

You can download *Sustainability Made Simple* at www.calacademy.org, or pick up a copy in the *Altered State: Climate Change in California* exhibit. Content for the guide was generated by Academy scientists and educators, with support from Pacific Gas and Electric Company, the Academy's lead sustainability sponsor.

California Academy of Sciences
**Sustainability
Made Simple**
**Everyday Choices
You Can Make
to Protect the
Planet's Future**

Helping Endangered Sea Turtles: It's a Family Affair

CONSERVATION BIOLOGIST Dr. Healy Hamilton is best known for her work with whales, dolphins, and seahorses. But sea turtles hold a special place in her heart, and as leader of the Academy's Center for Biodiversity Research, she is keenly aware of how climate change affects these and other creatures worldwide. "This group of organisms is more than 100 million years old," Hamilton says. "Only seven species remain on our planet, and all of them are endangered."

In August, Hamilton will lead a group of Academy members to Mexico's Pacific coast, where they'll observe olive ridley sea turtles coming ashore to nest, followed by hatchlings making their nocturnal migration back to the sea. "It's extremely moving to watch this deep evolutionary process," she says, "and to be so intimately involved in the eternal struggle for life." There's another reason Hamilton is so excited about this trip: it's the first Academy tour designed especially for families, an opportunity for kids to witness first-hand the miracle of evolution and survival.



The olive ridley has one of nature's most remarkable nesting behaviors, called an *arribada*—Spanish for "arrival." Hundreds to thousands of females gather in offshore waters before simultaneously crawling ashore to lay their eggs in the sand. The massive creatures, which have traveled thousands of miles in the ocean, must exhibit tremendous drive to crawl overland to nest. And the newborn hatchlings are tossed and tumbled in the strong surf as they return to sea.

The stretch of Oaxacan coast on the itinerary is considered one of the best possible spots to view the *arribada*, and it's one of Hamilton's favorite places in the world. There, forested mountains meet a dramatic coastline of sandy beaches and rocky outcroppings in a setting that still feels wild.

Academy travelers will begin their trip in Huatulco, where their home base will be a cliff-top ecolodge. From there they will make excursions to La Ventanilla, a restoration project and wildlife refuge on a mangrove estuary, and the National Turtle Sanctuary at Mazunte Beach. At La Escobilla Turtle Camp, the group will help protect the turtles from poachers during their extraordinary ritual.

Academy travelers will then journey to Puerto Escondido, where they will mingle with wild iguanas and exotic wetland wildlife. An excursion by boat will allow participants to snorkel and watch for tropical fish, dolphins, and possible mating activity by sea turtles.

Hamilton, who has led Academy whale-watching tours to Baja California, sees this trip as a chance to engage members of all ages in wildlife preservation. "For everyday people to become conservation activists, they must have a personal experience with it." She invites interested members to join her and bring a sense of adventure and curiosity. "And a fan! We're going to the tropics!"

See the World through a Scientist's Eyes

Expedition Highlights

- Witness one of nature's great wonders: turtles arriving ashore to bury their eggs in the sand after migrating hundreds, even thousands, of miles.
- Patrol vulnerable turtle beaches and help hatchlings return to the sea.
- Take a boat excursion to look for turtle mating activity in the ocean. Enjoy snorkeling and observing marine wildlife.
- Visit an iguana farm and the wetland habitat of Manialtepec Lagoon, home to exotic species of birdlife.

Trip Details

Destination: Sea Turtles of Mexico

Dates: August 17-22, 2009

Guide: Dr. Healy Hamilton

Cost: From \$2,495 (based on double occupancy plus airfare)

Upcoming Academy Adventures

Northern Spain and the Pyrenees

June 14 - 29, 2009

Academy Leaders: Frank and Mary Beth Almeda

Total Solar Eclipse in China

July 15 - 24, 2009

Academy Leader: Bing Quock

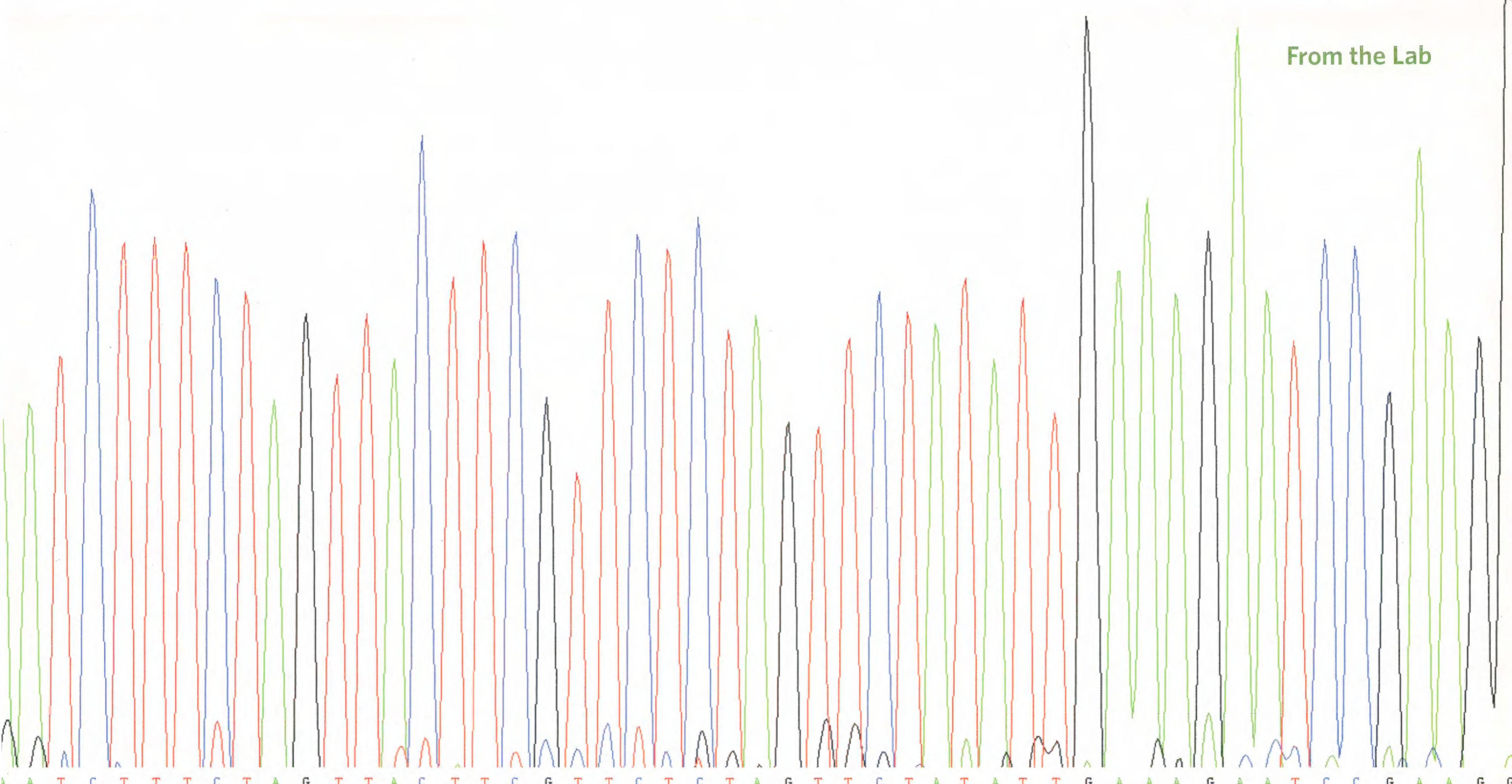
Exploring Alaska's Coastal Wilderness

August 29 - September 5, 2009

Academy Leaders: John and Pam McCosker

To learn more about upcoming Academy travel opportunities, please visit us online at www.calacademy.org/events/travel, call 800.853.9372, or email calacademy@hcptravel.com.





IT'S ALL IN THE GENES

BY STEPHANIE STONE

UNLIKE POLAR BEARS OR RAINFOREST FROGS, VULTURES are not an easy sell as conservation icons. Their bald heads don't make them particularly photogenic, and their feeding behaviors often earn them an undeserved reputation for being unclean. In many ways, however, these birds are unsung heroes in their ecosystems. Surviving mostly on leftover scraps and decaying meat, vultures prevent the spread of diseases by picking infected carcasses clean. Their featherless heads even ensure good hygiene in the process, staying much cleaner than a feathered surface could. By performing this garbage disposal service, vultures not only protect other animals and livestock—they also help to prevent the spread of diseases that infect humans, such as anthrax.

As recently as 1985, the Oriental White-backed Vulture (*Gyps bengalensis*) was one of the most abundant birds of prey in the world. Throughout the Indian subcontinent, it was easy to spot the soaring birds as they traced slow circles in the sky, searching for carrion below. They adapted well to human settlements, striking up a symbiotic relationship with

livestock owners by disposing of cattle and other animals that had reached the end of their lives. Then, in the early 1990s, the birds began to die off at alarming rates. By 2000, they were listed as Critically Endangered by the International Union for Conservation of Nature (IUCN). Across India and Pakistan, their numbers have now declined by more than 99 percent since 1992—a faster decline than any other wild bird, including the Dodo.

After several years of testing, scientists identified the culprit behind this startling decline: an anti-inflammatory drug called diclofenac, which is similar to ibuprofen. Widely used in human medical practices for years, diclofenac was introduced to the veterinary market on the Indian subcontinent in the early 1990s. Because it was inexpensive, the drug was rapidly adopted for treating inflammation, pain, and fever in cattle. By 2004, 92 percent of the surveyed veterinarians in Pakistan sold diclofenac on a daily basis. While cattle can tolerate high doses of the drug, vultures cannot. Shortly after feeding on livestock treated with diclofenac, the birds die from renal failure.

To understand—and protect—birds around the world, Academy scientist David Mindell studies their DNA.

In 2006, the veterinary form of diclofenac was outlawed in India, Pakistan, and Nepal. However, the drug remains widely available, and population numbers for the Oriental White-backed Vulture continue to plummet across the Indian subcontinent. Their precipitous decline is now being felt in a variety of ways. Without vultures to scavenge the region's dead livestock, populations of feral dogs have increased dramatically, leading to a higher incidence of rabies. Three towns in India have experienced outbreaks of anthrax, likely from villagers handling infected cattle carcasses. And the Parsis, a religious sect in India that relies on vultures to give their dead a proper "sky burial," have resorted to installing solar reflectors to help decompose dead bodies, since there are no longer enough vultures to do the work.

BASED ON THE CURRENT TRENDS, SCIENTISTS ESTIMATE that the Oriental White-backed Vulture will be extinct in the wild in less than a decade. The only hope for the bird's survival is to establish an aggressive captive breeding program, which would enable scientists to reintroduce vultures to the wild once diclofenac is no longer in use. Small breeding programs have now been initiated in both India and Pakistan. However, in order for these programs to be most effective, they must preserve the maximum amount of genetic diversity within the species. This diversity is the key that allows species to adapt to changing environments over time. To help guide these captive breeding efforts, Academy scientist David Mindell and a group of colleagues set out to study the Oriental White-backed Vulture's DNA.

Mindell and his colleagues started by comparing the genetic diversity of Pakistan's last remaining breeding colony of wild Oriental White-backed Vultures to the historic levels of diversity found in museum specimens collected between 1893 and 1960.

Despite the dramatic population declines the vultures suffered in the 1990s, the team found that during the 2000-2001 breeding season, the colony contained just as much genetic diversity as the historical museum specimens. However, by 2005, the number of occupied nests in the breeding colony had declined even farther, and the amount of genetic diversity was beginning to drop.

Next, Mindell's team modeled the amount of genetic diversity that would be maintained over time in the newly established captive breeding programs, which included 11 birds in Pakistan and 70 in India. Their results showed that the current stocking levels were too low to maintain the already shrinking levels of genetic diversity in the wild. In order to maintain 90 percent of the existing diversity

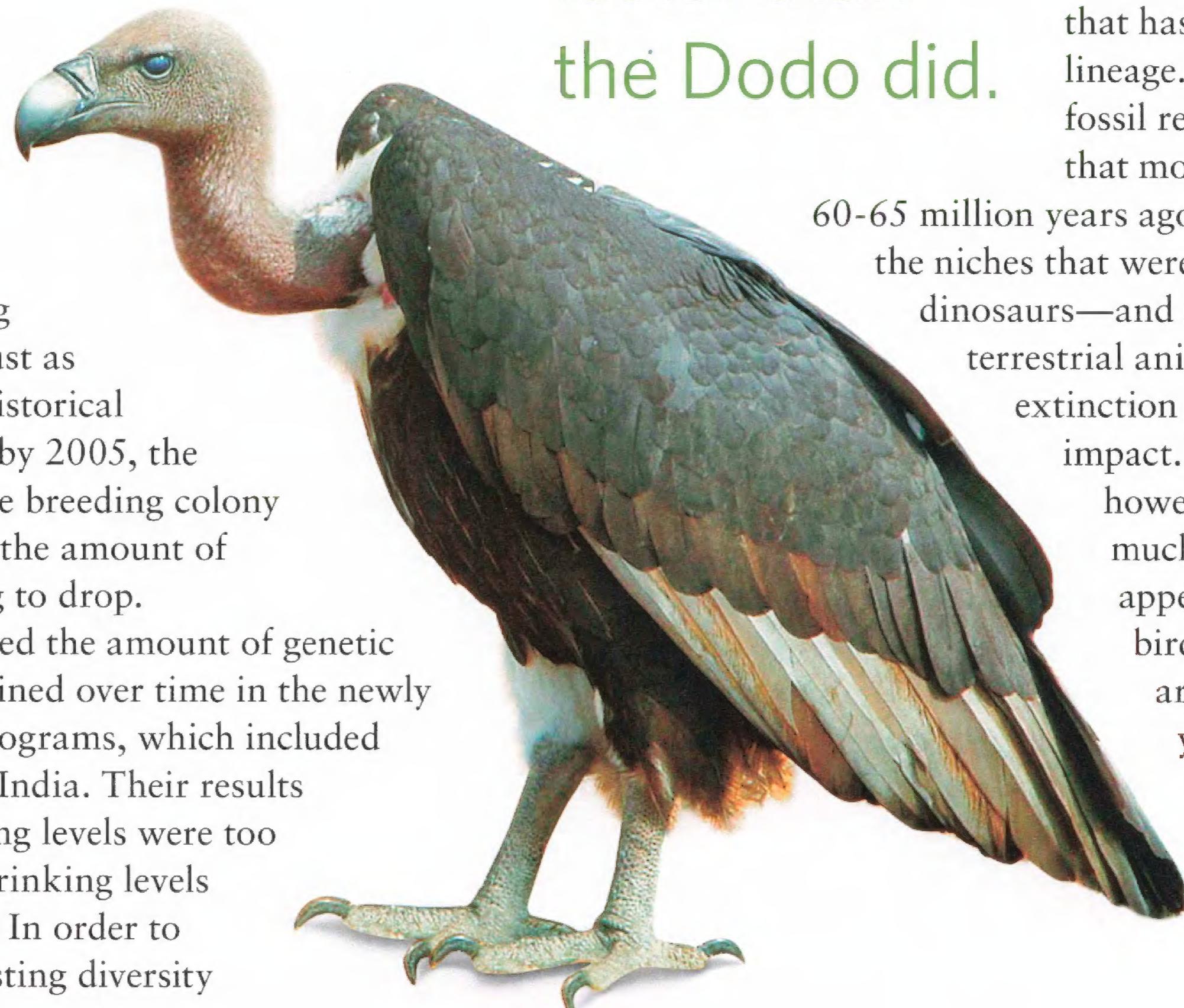
over the next 100 years, the breeding program would need to grow to accommodate at least 300 birds. The team's results suggested a clear course of action for protecting the Oriental White-backed Vulture: before more diversity was lost, at least another 210 birds should be rescued from the perils of diclofenac and sequestered in a captive breeding program until the drug was no longer a threat. This has provided the impetus for bringing more birds into the breeding programs before the species goes extinct in the wild, which now seems inevitable.

DETERMINING A POPULATION'S LEVEL OF GENETIC diversity is just one of the many reasons to study DNA. Another is the ability to determine evolutionary relationships and piece together the history of life on Earth. Mindell recently tackled a genetic study of mammoth proportions in order to answer a long-debated question about the origin of modern birds.

Scientists currently use two primary methods to assign dates to evolutionary events, colloquially called 'rocks' and 'clocks'. The 'rocks' method involves finding relevant fossils and isotope-dating either the fossil itself or the surrounding rock layers. The 'clocks' method rests on the idea that the rate of error in DNA replication is relatively constant when averaged over time and across species, allowing scientists to measure elapsed time by the amount of DNA change that has taken place in a lineage. Traditionally, the fossil record has indicated that modern birds arose about 60-65 million years ago, theoretically filling the niches that were left when non-avian dinosaurs—and at least half of all other terrestrial animals—were driven to extinction by a major asteroid impact. Molecular work, however, has indicated a much older date for the appearance of modern birds, suggesting that they arose about 100 million years ago and survived the mass extinction.

Neither method of dating is perfect. The fossil record isn't

Oriental White-backed Vultures in India are now declining faster than the Dodo did.



Q&A with David Mindell

Q: When did you first become interested in birds?



A: My interests in natural history started early as a result of camping, fishing and dissecting road-killed animals with my father, a physician. We would do this just to see how they worked. I had a wonderful collection of bird skulls in the freezer—until they were discovered. My interest in birds became more focused while I was an undergraduate student and avid falconer in Arizona. I trained and hunted with Red-tailed Hawks, Goshawks, and a Prairie Falcon. As a graduate student I conducted field work in Alaska, including extensive river surveys and habitat assessment for breeding Gyr and Peregrine Falcons. I also began saving feathers and blood samples for extraction of DNA and molecular analyses.

Q: In addition to conducting active research, you are also the Academy's Dean of Science and Research Collections. Why are those collections so important?

A: The importance and function of our collections is to support scientific research, as conducted by Academy scientists and our colleagues around the world. The aim of our research is to discover how life has evolved. We want to understand how all life forms are related and how organisms, their genomes, and their environments have changed over time. We seek this knowledge for two basic reasons: first, we want a factual understanding of the natural world for its own sake. We're curious. The second reason, underlying the first, I suspect, is that knowledge is power. The more we understand about the natural world, the more power we have to promote the health of the planet and human well-being.

genetically distinct enough to be considered a separate species, and the Grenada kites deserved subspecies status.

These findings have helped to establish the Hook-billed Kites in Cuba and Grenada as conservation priorities, since both groups are threatened with extinction. The Cuban species (*Chondrohierax wilsonii*) has not been reliably documented since 1992, and less than 50 members of the Grenada subspecies (*Chondrohierax uncinatus mirus*) currently inhabit the island. Both populations are now listed as Critically Endangered, and efforts are underway to address some of the threats the birds face, such as a shortage of tree snails due to over-collecting and a mistaken belief that the kites prey on poultry.

Hook-billed Kites and Oriental White-backed Vultures are not alone in their conservation status—nearly 200 species of birds around the world are currently listed as Critically Endangered by the IUCN. While they face an uncertain future, the DNA research that scientists like Mindell are conducting is helping to give them the best possible chance at survival, strengthening our understanding of evolutionary processes, garnering added legal protection for newly described species, and providing guidance for successful captive breeding programs.

complete for any species, and it is especially spotty for birds, which—because of their aerodynamic bodies—have very delicate bones. Moreover, the fossil record cannot document morphological changes until long after species have diverged from one another. However, molecular clocks also have some inherent flaws. For example, different lineages accumulate genetic changes at different rates, so estimates for evolutionary time will vary depending upon the lineages that are analyzed.

To help shed light on this debate, Mindell and a group of colleagues embarked on an intensive effort to estimate more accurate molecular clocks, utilizing new statistical methods to compensate for the varied rates of molecular change across genomes. They used 18 different well-established fossils to anchor their clock in concrete dates and built a genealogical tree that included 135 different species of birds. This mountain of genetic testing all pointed to a single conclusion: based on their genes, modern birds appear to have arisen deep in the Cretaceous, before the mass extinction that wiped out the non-avian dinosaurs. Mindell's finding reinforces an idea that is often overlooked in evolutionary discussions—there is a significant lag time between the initial divergence of two lineages and the development of new diagnostic traits. The 'clocks' method is tied to the first event, while the 'rocks' method measures only the second event. "This is the type of research that helps us understand the mechanisms for evolutionary change," explains Mindell.

In addition to helping scientists construct evolutionary trees and timescales, DNA data is also extremely valuable in efforts to identify and name new species. This type of species identification work is increasingly important because the conservation laws in many countries, including the United States, are built around endangered species rather than endangered habitats. The best way to protect a threatened place is often to identify an endangered species within its boundaries. Mindell recently used DNA evidence to identify a new species of Hook-billed Kite—one of the most critically endangered raptors in the world.

Until recently, scientists only recognized one species of Hook-billed Kite (*Chondrohierax uncinatus*), which ranged from southern Texas to northern Argentina and Paraguay, including two island populations on Cuba and Grenada. Related to eagles and hawks, these birds of prey feed primarily on tree snails, which they deftly extract from their shells

using their long, hooked beaks. Across their range, the kites exhibit a high degree of variation in beak size, an adaptation that allows the birds to specialize on snails of different sizes. They also display a wide range of coloration patterns—especially in Cuba, where the kites have bright yellow bills instead of the black bills observed elsewhere. To determine whether or not the birds still belong in a single species, Mindell analyzed DNA from individuals throughout the Hook-billed Kite range, including specimens from both Cuba and Grenada. His results indicated that the Cuban birds were

Evolve 2009 Programs



The Academy presents the following programs as part of Evolve 2009, a San Francisco celebration of evolution in honor of the 200th anniversary of Charles Darwin's birth and the 150th anniversary of *On the Origin of Species*. **Location for all programs:** California Academy of Sciences.

Darwin Series Lectures

Price: Free with Academy admission. Seating is limited. Reserve a seat by calling (415) 379-5494.

Charles Darwin and the Heyday of Natural History

Tuesday, March 3 at 12:15 pm

John Dillon
Lecturer, University Extensions at Berkeley, SF State, and Stanford



Never has the public taken a greater interest in natural history than in the mid-19th century when Charles Darwin was developing his revolutionary insights.

John Dillon will examine the irony of how Darwin's work was nurtured by this heyday, yet hastened its demise.

Collecting Evolution: The Story of Darwin's Vindication by the Academy's 1905-06 Galapagos Expedition

Tuesday, March 10 at 12:15 pm

Matthew James, Ph.D.
Professor of Paleontology and Geology
Chair, Sonoma State University

The 89-foot schooner Academy set sail in June 1905 and collected some 75,000 biological specimens from the Galapagos. James will examine the background of the expedition, the lives of the scientists on board, and the lasting significance today with regard to conservation and DNA studies.

Bookworms (An Adult Book Group)

Price: Free. Reserve a space by calling the Naturalist Center at (415) 379-5494.

What Did Darwin Learn on the Beagle?

Tuesday, March 10 at 6:30 pm

Darwin's book, *The Voyage of the Beagle*,

is a travel memoir, an adventure story, and a scientific primer. In it Darwin observed nature and began to shape his thinking on evolution. Join a book discussion focusing on Chapters 1-4, 8-9, and 17.

Teens Talk Books

Price: Free with admission. Reserve a space by calling (415) 379-5494.

Can You be Both Scientific and Religious?

Saturday, March 21 at 11:00 am

Mena was looking forward to starting high school. But she quickly finds herself shunned by her old friends and parents as she becomes embroiled in the evolution vs. intelligent design debate. Join a teenage discussion of the book *Evolution, Me & Other Freaks of Nature* by Robin Brande.

Charles and Emma: The Darwins' Leap of Faith

Saturday, April 4 at 11:00 am

Join a teenage discussion of the book *Charles and Emma: The Darwins' Leap of Faith*, a very intimate biography of Charles Darwin by Deborah Heiligman.

Pritzker Lectures

Price: Free for members, \$10 non-member adults, \$8 non-member seniors. Seating is limited. Reserve a seat or purchase lecture tickets by calling (800) 794-7576. Tickets for admission to the rest of the Academy are separate and optional.



Darwin, Dover and Intelligent Design

Tuesday, March 24 at 12:15 pm and 6:30 pm

Kevin Padian
Professor of Integrative

Biology, UC Berkeley

Padian was an expert witness in the 2005 Pennsylvania trial, *Kitzmiller v. Dover*, that ruled against the teaching of intelligent design in public schools. He will discuss his experience and what's next for "intelligent design."

Discovering and Interpreting Hominid Fossil Remains

Tuesday, April 14 at 12:15 pm and 6:30 pm

Zeray Alemseged, Ph.D.
Academy Curator of Anthropology



Alemseged will discuss recent discoveries related to hominid fossil remains and their environments, and how these various environmental and ecological factors may have affected primate and human evolutionary processes.

Leakey and Darwin Series Lecture

Price: \$8 for Academy and Leakey members and non-member seniors, \$10 non-member adults. Purchase tickets by calling (800) 794-7576.

Darwin and the Descent of the Emotionally Modern Man

Speaker series jointly presented with the Leakey Foundation

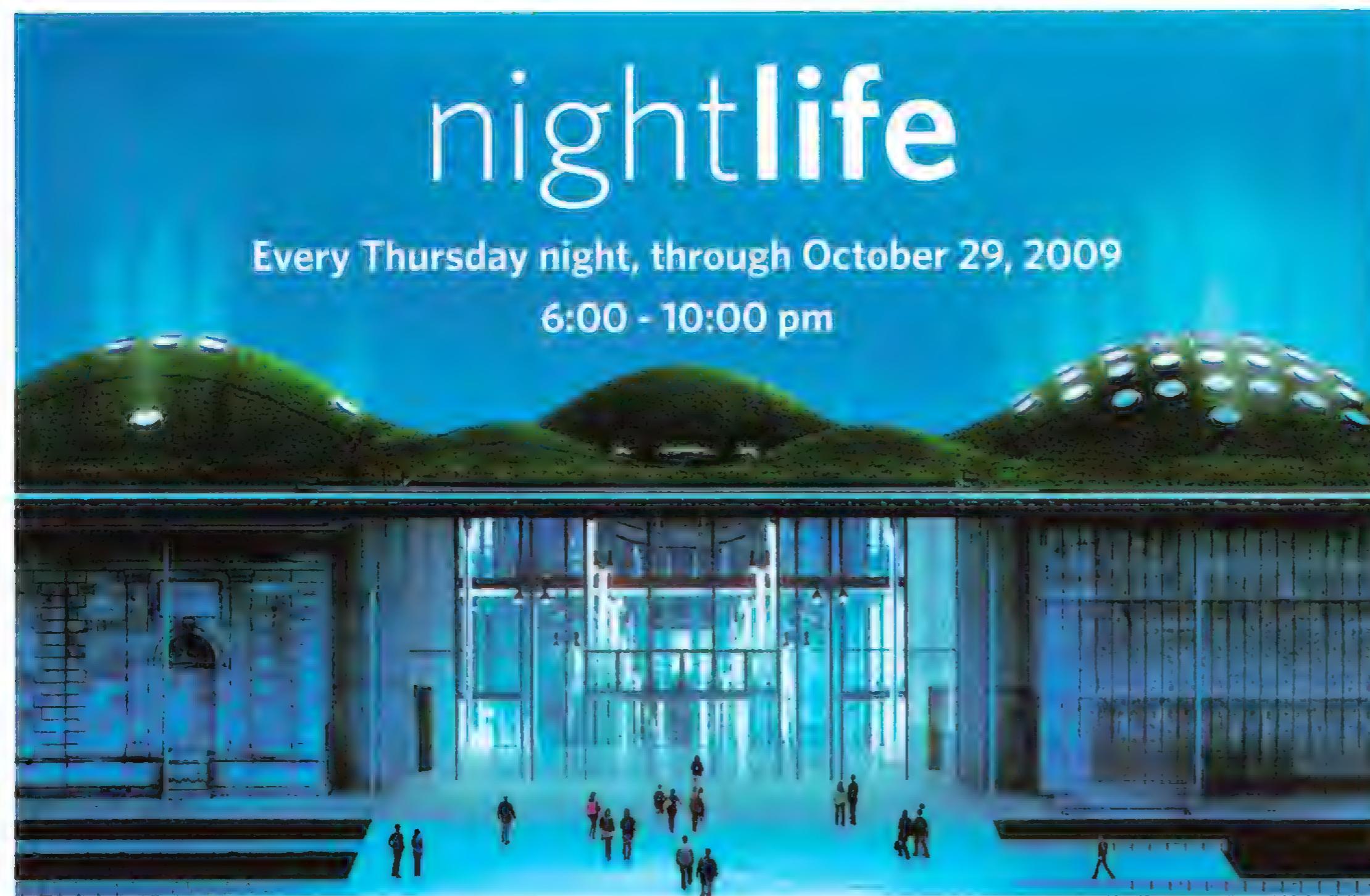
Tuesday, May 19 at 7:00 pm



Sarah Hrdy
Professor Emerita, UC Davis

According to widely accepted chronology, *anatomically modern humans* evolved around 150,000 years ago, and *behaviorally modern humans*, capable of symbolic thought and language, emerged 50,000-80,000 years ago. But Hrdy argues that *emotionally modern humans*, newly interested in the mental and subjective states of others and inclined to give and share, emerged in the genus *Homo* far earlier, perhaps 1.8 million years ago.

Nightlife Programs



NightLife admission: \$8 members, \$10 non-members. NightLife is for patrons ages 21 and over; a valid ID is required for entry. To be placed on the NightLife email list, visit www.calacademy.org/nightlife.

Gaze into the stars, test your science-savvy in a science café, get up close and personal with aquarium critters, explore art with a scientific edge, and much more during the Academy's weekly NightLife events. Special programming will be featured on the following nights:

March 19: DIY DNA Panel Discussion In Partnership with WIRED Magazine



No longer the sole province of genetics labs and physicians, this is the era of Do It Yourself DNA. For \$400, we can get a peek at our genome, and a range of new genetic tests can diagnose hundreds of specific diseases. Wired's Deputy Editor Thomas Goetz will talk with Linda Avey, cofounder of the revolutionary company 23andMe, whose Personal Genome Service™ was recently named by *Time* magazine as the Invention of the Year, and Dr. Hugh Rienhoff, founder of

MyDaughtersDNA.org, who has created an international online project to research the genetic cause of his daughter's mysterious illness. They will discuss the new potential of collaborative research in human genetics: what our DNA can and cannot tell us about our health. Sponsored by Northwestern Mutual Financial.

Note: Space is limited; reserve a seat by calling (415) 379-8000 or online at www.calacademy.org/nightlife. This program starts at 7:00 pm.

April 9: Yuri's Night, the World Party for Space



NightLife goes interstellar to celebrate the anniversary of Yuri Gagarin's first flight into space (1961) and the first launch of the U.S. Space Shuttle (1981). For more information on this global event, visit <http://yurisnight.net/main>.

April 23: Earth Week Activities

Check www.calacademy.org for details about an evening that focuses on sustainability and good eco-practices.

The Nightlife series is sponsored by Facebook.

New Exhibits

Enjoy two new photo exhibits this spring and summer in the Hearst Forum Gallery and the Level 2 and Level 3 balconies.

A Climate for Life: Meeting the Global Challenge January 17 - April 12, 2009

Many dramatic effects of climate change are in remote places that most people will never see. A new exhibition by Conservation International and the International League of Conservation Photographers (*iLCP*) attempts to bring these places to life through stunning photographs. Photograph below by Michael Forsberg, member of the *iLCP*.



From Earth to the Universe: A Visible Journey through the Wonders of the Universe April 25 - September 20, 2009

This collection of images from NASA, the Hubble Space Telescope, and professional and amateur astronomers represents the incredible variety of astronomical objects that are known to exist.



Earth Day 2009: Connect and Protect



The 39th annual International Earth Day officially falls on April 22, but the Academy will offer a wide variety of eco-friendly events throughout the month of April. Stop by to connect with nature—and each other—and learn what you can do to help protect the only planet currently known to support life.

Bookworms (An Adult Book Group) Why We Need a Green Revolution Tuesday, April 7 at 6:30 pm

In honor of Earth Day, the book group will read Pulitzer Prize-winning author Tom Friedman's latest book, *Hot, Flat, and Crowded*. Friedman examines the global environmental crisis and offers suggestions on how the U.S. can change its energy practices and implement something he calls Code Green. **Price:** Free. Reserve a space by calling the Naturalist Center at (415) 379-5494.

Spiders: Science and Myth Thursday, April 9 and Saturday, April 11 at 3:00 pm

In this family-friendly program, naturalist Martin Nicholas will discuss the amazing feats of spiders that he has observed on expeditions around the world. Free with Academy admission.

Sustainability Fair Saturday-Sunday, April 18-19 From 10:00 am - 5:00 pm

Talk to eco-friendly partner organizations from the Bay Area, and find new ideas for leading a more sustainable life. Check www.calacademy.org for more information. Free with Academy admission.

The 39th annual International Earth Day officially falls on April 22, but the Academy will offer a wide variety

Explore Golden Gate Park with a Naturalist

**Saturday-Sunday, April 18-19 and
25-26 from 10:00 am - 12 noon**

Learn about the Academy's wild neighbors, the fragile ecosystems where they live, and what you can do to help protect them. Meet at the Naturalist Center and come dressed for outdoor activities. **Price:** Free with Academy admission. Limited to 30 people per session; RSVP required at (800) 794-7576.

Hands-On Nature

**Saturday-Sunday, April 18-19 and 25-26,
and Wednesday, April 22 at 10:30 am**

Visitors of all ages are invited to join a hands-on, family activity that inspires an appreciation for the natural world. Free with Academy admission.

Every Day Is Earth Day

**Saturday-Sunday, April 18-19 and 25-26,
and Wednesday, April 22 at 3:00 pm**

Fun ways to protect the environment in your everyday life. Free with Academy admission.

Living with Wolves

Tuesday, April 28 at 7:00 pm

Jim and Jamie Dutcher



Join the Dutchers for a film and presentation about their experiences living among gray wolves in a camp at the edge of Idaho's Sawtooth Wilderness. Lauded for their work as documentary filmmakers and featured on the Discovery Channel, the Dutchers are dedicated to raising public awareness about the social nature of wolves and their importance to healthy ecosystems.

Price: \$8 for members, seniors, and students; \$10 non-member adults. Seating is limited. Purchase tickets by calling (800) 794-7576.

Teacher Programs

BioForum

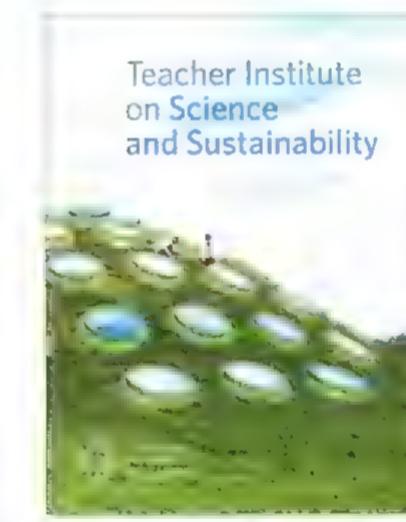
Conservation Biology: The Principles and Practice of Conserving Life's Diversity

Saturday, April 4 from 8:30 am - 4:00 pm

Note: This event is restricted to current science teachers.

From local land trusts to federal agencies, humans are increasingly responsible for managing what remains of natural landscapes. The field of conservation biology applies evolutionary and ecological knowledge to understand how human actions both positively and negatively affect the natural world. In this BioForum, basic principles of conservation science and examples of their real-world applications will be presented. Moderated by Dr. Healy Hamilton, Director of the Center for Biodiversity Research at the Academy.

Price: \$30 for current science teachers (lunch included). Call (415) 379-8000 to register.



Teacher Institute on Science and Sustainability

The Teacher Institute on Science and Sustainability is a hands-on program designed to provide teachers with the critical tools and knowledge to inspire future generations to protect our most precious resource: the planet Earth.

Starting in June 2009, each year a select group of 3rd-5th grade teachers will embark on a two-year program to become leading educators of science and sustainability. The program will include in-depth workshops at the Academy as well as exciting visits to organic farms, green buildings, scientific institutions, and more. Program topics include climate change, energy use, and food and water choices. To find out more, visit www.calacademy.org/teachers/tiss.

Benjamin Dean Astronomy Lecture Series

Location: Morrison Planetarium, California Academy of Sciences

Tickets: Purchase tickets in advance by calling (415) 379-8000.

Seating is limited and tickets are first-come, first-served.

Price: \$5 for members, \$10 non-member adults, \$8 non-member seniors

Time: All programs begin at 7:30 pm

Questions: Email deanseries@calacademy.org or call (415) 379-8000

Iconic Images from the Hubble

Space Telescope: Their Meaning for Astronomy and for Humanity

Monday, March 16

Sandra Faber

University of California, Santa Cruz



Dr. Faber will tour the Universe with the most beautiful and notable images from the Hubble Space Telescope. She will use these as a springboard to discuss the impact that modern astronomical images have had on the thinking about the history, role, and future of the human species in the Universe.

Habitable Worlds in the Universe: The Search Begins

Monday, April 6

Geoff Marcy

University of California, Berkeley



Science fiction assumes that the Milky Way Galaxy abounds with habitable planets populated by advanced civilizations engaged in interstellar commerce and conflict. Back in the real Universe, Earth-like planets and alien life have proved elusive. Has science fiction led us astray? In 2009, astronomers will launch the first searches for Earth-like worlds around other stars, using bizarre, extreme telescopes for the task. These telescopes fundamentally supersede Galileo's historic little scope for the first time. A wild race for signs of inhabited worlds and extraterrestrial life is about to begin.

Are We Alone? We Don't Know, but We're Trying to Find Out

Monday, May 4

Jill Tarter

Center for SETI Research, SETI Institute



Throughout recorded history, humans have looked at the sky and wondered whether life exists elsewhere. Today, new observational tools allow humans to conduct experiments that shed light on the problem. This lecture summarizes the scientific exploration for extraterrestrial intelligence, and highlights the newest telescopes that may provide an answer.

Conversations at the Herbst Theatre

Monday, March 30

Paul Ehrlich, President, Center for Conservation Biology, Stanford University

In conversation with Healy Hamilton
The Dominant Animal, One with Nineveh, The Population Bomb

Wednesday, April 15

Kay Ryan, United States Poet Laureate 2008

In conversation with David Ulin
The Niagara River, Elephant Rocks, Say Uncle

The Annual Claire Matzger Lilienthal Distinguished Lecturer

Monday, April 20

Maya Lin, Artist, Sculptor

In conversation with Ryan Wyatt
Vietnam Veterans Memorial, Civil Rights Memorial, Where the Land Meets the Sea

Tuesday, May 26

James Hansen, Head of NASA

Goddard Institute for Space Studies & Adjunct Professor, Department of Earth & Environmental Sciences, Columbia University

In conversation with Mark Hertsgaard

Location: Herbst Theatre, 401 Van Ness Avenue, San Francisco

Time: All programs begin at 8:00 pm

Price: \$18 members, \$20 non-members; purchase series tickets for \$96 members, \$108 non-members

Tickets: Call City Box Office at (415) 392-4400 or visit www.cityboxoffice.com. The Academy does not process ticket orders for these lectures.

This series is presented by City Arts & Lectures, Inc. It is made possible, in part, by a grant from the Richard and Rhoda Goldman Fund, the Myers Family Fund, and the Lilienthal Family Fund.

Mapping the



Two Academy scientists use new technology to create a modern day treasure map of the Philippines

BY ANDREW NG

JUST TWO DECADES AGO, SCIENTISTS on an expedition often felt like they were in the middle of nowhere. When Academy curators Terry Gosliner and Gary Williams first started diving on the Philippine coral reefs in 1992 to survey their aquatic diversity, they did not have the aid of a Global Positioning System (GPS) to pinpoint their location, or the wealth of background information and planning that the World Wide Web

makes possible today. All they had were tourist maps from local hotels, and pencil and paper to record their approximate dive locations. Back then, a leap into the sparkling blue waters of the Philippines was like a leap into the unknown.

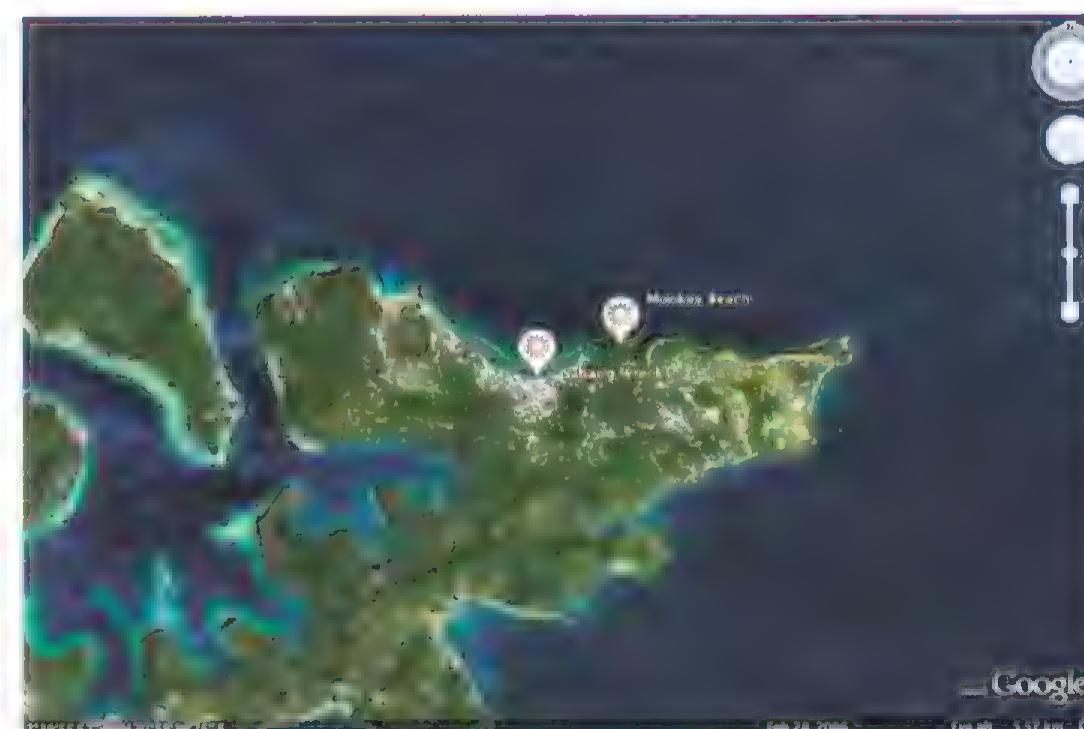
Technology has made tremendous strides since then. Now, when Gosliner and Williams explore the waters of the Philippines, they use hand-held GPS receivers to determine their exact

Richest Reef



latitude and longitude. They take thousands of underwater photographs with digital cameras, then upload the photographs to MacBook Pros and sort through them at night. And they can use the Internet to plan their expedition route, establish email contact with local officials, and share information instantly with other scientists.

Thanks to GPS technology, the specimens they have documented since the early 2000s are accompanied by



A screenshot of the Academy's new interactive map of the Philippines.

precise geographic information, which allows them to map the diversity of aquatic animals at a very fine scale. Their data supports the notion that the Philippines, and specifically the Verde Island Passage in the northern part of the archipelago, is the most diverse marine area in the world.

But what about the data they collected in the technological dark ages, before the advent of GPS? Almost half their specimens did not have latitudes



Academy scientists Gary Williams (left) and Terry Gosliner in front of the Academy's Philippine Coral Reef tank.

Their data suggests that the Verde Island Passage in the Philippines is the most diverse marine area in the world.

and longitudes associated with them. The only geographic descriptions for these early specimens came from dive logs, and the entries were often vague (e.g., "off Seafari Beach," "Kirby's Rock," and "Cemetery Beach"). Knowing the latitude and longitude of early collecting sites would be invaluable—Gosliner and Williams would be able to fill the gaps in their historical data sets and paint an even more accurate, and comprehensive, picture of diversity in the Philippines.

It seemed like the scientists' only option was to return to all their dive sites from the 1990s with a GPS device—an expensive and time-consuming prospect. But then they discovered salvation in another form of

technology: Google Earth software.

"We started playing with Google Earth about a year ago," says Williams. "It was amazing. The software allowed us to view the Philippines from space. Using satellite imagery, we found islands we had visited a decade ago. We were able to zoom in to the specific reefs we dove on, and then retroactively determine the latitude and longitude of our dive sites."

Google Earth, which is free and available to anyone with an Internet connection, allowed the scientists to re-visit the Philippines from the comfort of their offices in San Francisco. The resolution of the satellite imagery was such that they could identify reefs (greenish areas), sand flats (turquoise-blue areas), and deep water (dark blue areas) from overhead. They could see landmarks like hotels, lighthouses, and beaches that matched their field notes and old photographs, which confirmed that they were seeing the same locations as on their past dives.

"The level of precision was incredibly high," says Gosliner. "We could get within five to ten meters of a point. We could measure distances between two points if we wanted to. We could even see waves on the ocean and a Filipino person paddling in an outrigger canoe."

While this technology turned out

to be a boon for their research needs, Gosliner and Williams also felt that the information could be shared with a wider audience. So they worked with the Academy's Web team and Research Informatics department to put an interactive map of the Philippines online. It debuted in February and can be found at www.calacademy.org.

"The map consists of 11 pins representing dive sites," says Gosliner. "When you click on a pin, you will see a sample of the different animals we found there, with new or endemic species highlighted, photographs of specimens, descriptive text, and links to more information."

This interactive map has many uses. It can serve as an educational tool for teachers in the classroom, as well as for casual visitors to the Academy's website. It can serve as background research for other scientists who are interested in the Philippines. But perhaps the most important application for the map, and the scientific data behind it, lies in ocean conservation. The Philippines forms one point of the "Coral Triangle," an area long considered to have the world's highest diversity of marine animals. (Borneo and New Guinea form the other two points of the triangle.) To protect this diversity, Gosliner, Williams, and other Academy staff

Q&A with Terry Gosliner and Gary Williams

Q: What kinds of animals do you study?

TG: My specialty is nudibranchs, also known as sea slugs. They are among the most photogenic animals in the world. They are often richly decorated with iridescent spots, ornate tentacles, translucent skin, and almost any color you can think of.

GW: I study octocorals, which include soft corals, sea fans, and sea pens. They are characterized by having eight feathery tentacles around their mouths. They are not the reef-building corals you typically think of, but they do exhibit a wide variety of body forms and live in many habitats, from shallow reefs to deep-sea trenches.

Q: What is the level of diversity you've observed in the Philippines for your respective animal groups?

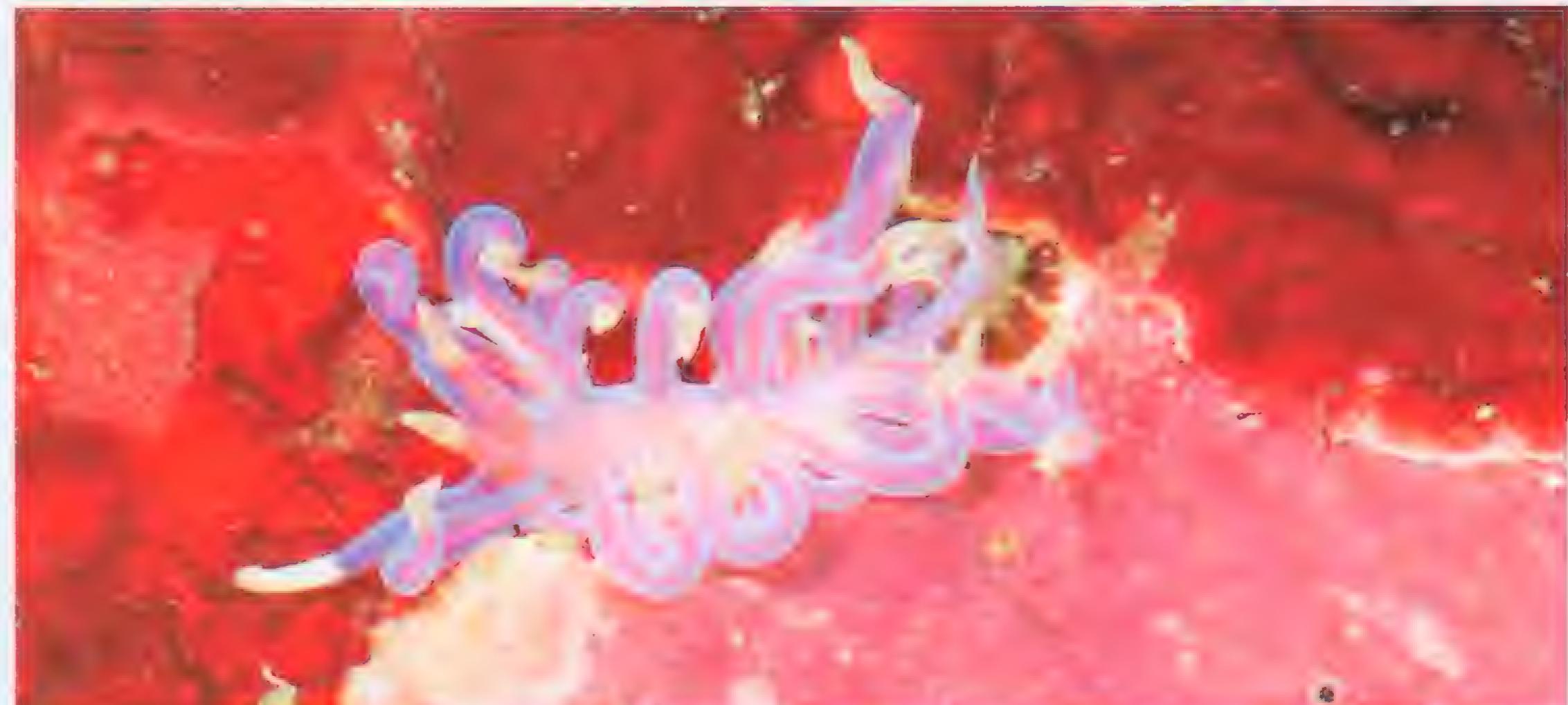
TG: The Philippines has the highest nudibranch diversity in the world. On our interactive map, some sites could have had more than 100 nudibranch specimens associated with them. On my last expedition alone, I found 40 new species.

GW: At one dive site in the Philippines, I found 120 different octocoral species. That's more species than in the entire Caribbean Sea. I'm currently sorting through 300 specimens from my latest expedition—by the time I'm through, I might have discovered a few new species.

Q: What resources are available for coral reef enthusiasts?

TG: Last year, I published *Indo-Pacific Nudibranchs and Sea Slugs: A Field Guide to the World's Most Diverse Fauna*. It contains 1,400 different species along with brilliant photographs. This comprehensive guide was a 10-year labor of love and involved dozens of collaborators.

GW: In 1996, I worked with Gosliner and colleague David Behrens to publish *Coral Reef Animals of the Indo-Pacific*, an illustrated field guide. Also, anyone interested in octocorals specifically can visit the Octocoral Research Center, my online website, at http://research.calacademy.org/research/orc_home.html.



Top: *Cespitularia* coral. Bottom: *Phyllodesmium* sea slug.

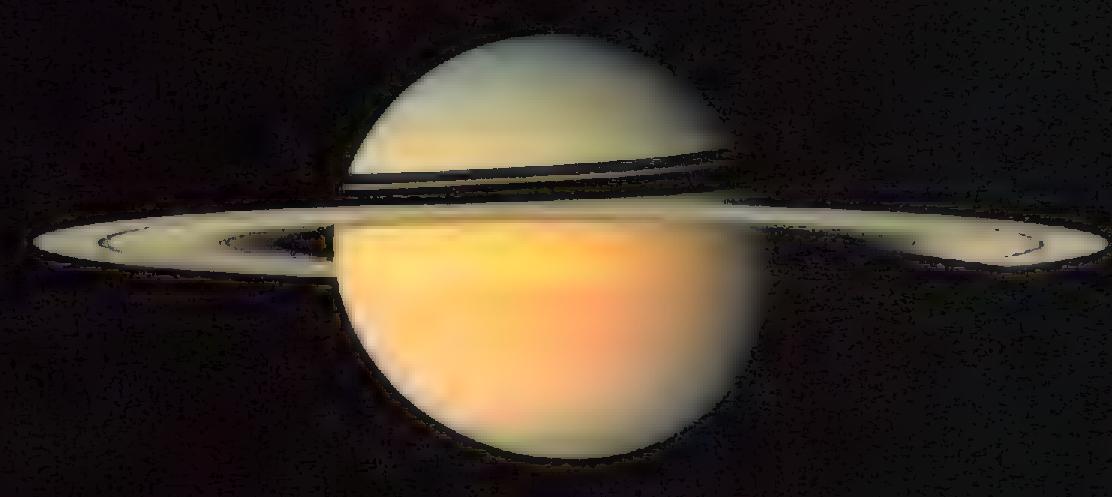
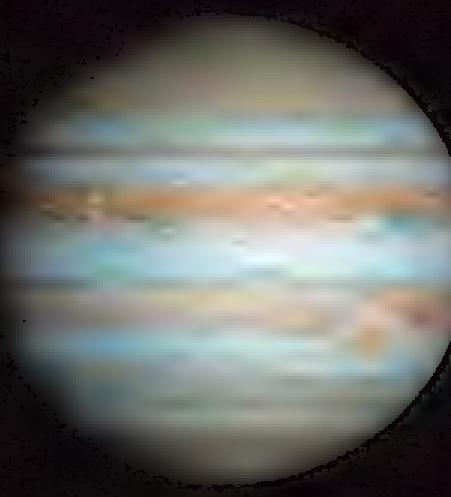
have spent years collaborating with the Philippine government and providing outreach to local conservation groups. Their finescale, scientific assessment of diversity in the Philippines, amassed from seven expeditions and hundreds of SCUBA dives spanning 17 years, will inform their recommendations for marine protected areas.

"The government appreciates our efforts," Williams says. "They are very interested in protecting the country's marine resources, because many Philippine communities depend on the reefs for food. If the government is faced with a triage situation, and they have to decide which areas to protect over others, they can use our diversity data to determine the areas that are more biologically valuable. And progress is occurring at the local level, too. Some of the more destructive fishing practices, like use of dynamite and cyanide, have tapered off since the 1990s."

Conservation efforts for Philippine coral reefs also occur closer to home. The Academy's 212,000-gallon Philippine Coral Reef exhibit was designed, in part, to instill a sense of stewardship in Academy visitors. In addition, the Academy recently signed a memorandum of understanding with Pusod, a non-governmental organization based in the Philippines and Berkeley, California, formalizing a partnership between the two organizations to preserve and promote the ecosystems of the Philippines.

So what's next for Gosliner and Williams? In February, Google Earth unveiled a new version of the software that incorporates ocean depth data. Users can click on an underwater location and dive virtually into the water to see a shipwreck, coral reef, trench, or other submerged feature. By incorporating the depths of their dives, which they already have from their field notes, Gosliner and Williams can add yet another dimension of interactivity to their map of the Philippines. The scientists are also creating similar maps for two other regions with a history of Academy expeditions: Papua New Guinea and Madagascar. If the success of the Philippines project is any indication, these two biodiversity hotspots will benefit from the same synergy of technology, science, and conservation.

skyguide



Mercury

36 million miles from the Sun

Passing superior conjunction on March 31, Mercury is already retreating from the morning sky at the beginning of March, and can be seen only with difficulty in the southeast just before dawn near Mars and Jupiter. Hidden in the Sun's glare for most of the month and for the first week or two of April, it emerges into the evening sky in early-to-mid April. Use the crescent Moon to help find it just above and to the left on the evening of April 25 and directly below on April 26, after which it again becomes obscured by the Sun.

Venus

67.2 million miles from the Sun

For most of March, Venus is an evening object, setting after sunset, but slowly drawing toward the Sun. It passes the Sun on March 27 (i.e., at inferior conjunction) and into the morning sky. As it emerges from the morning twilight, it rises parallel with Mars in early April, then climbs higher. Venus and the Moon are both washed from view by the Sun's glare during their close encounter on March 26, but look for them rising together in the east on the mornings of April 22 and May 21.

Mars

141.6 million miles from the Sun

The Red Planet remains well-hidden in the Sun's glare for most of March, during which it rises less than an hour before dawn. Then, as its separation from the Sun increases, it starts appearing very low in the east in the morning sky. It rises earlier each day and slowly moves from the stars of Aquarius into those of Pisces. The crescent Moon sweeps near Mars on the mornings of March 24, April 22 (with Venus less than one degree from the Moon), and May 21, when the Moon, Venus, and Mars form a compact triangle in the east before dawn.

Jupiter

483.6 million miles from the Sun

The largest of the planets is just emerging into the morning sky as March begins, rising in the east-southeast about an hour before dawn against the stars of Capricornus. Rising slightly earlier each morning, it gradually distances itself from the Sun and is higher in the sky by dawn. Look for the Moon nearby on the mornings of March 22, April 19, and May 17.

Saturn

886.7 million miles from the Sun

The Ringed Planet is at opposition on March 8, when it rises in the east at sunset and is visible all night long against the stars of Leo the Lion, at its largest apparent diameter for the year. However, the planet's rings are currently oriented almost edge-on to Earth, so they're nearly invisible—and because the rings' broad face can contribute significantly to the

overall brightness of Saturn in the sky, the Ringed Planet seems just a little dimmer than usual. Rising about four minutes earlier from one day to the next, by April Saturn is located in the southeast at sunset, and by May, it's high in the south at daylight's end. The Moon swings nearby on the evenings of March 9 and 10, April 6, and May 3.

Moon Missions

Currently scheduled for launch on April 24, 2009, NASA's Lunar Reconnaissance Orbiter (LRO) will spend a year in polar orbit, taking high-resolution images of the lunar environment in preparation for a human return. Aboard the same launch rocket, another mission called LCROSS (Lunar Crater Observation & Sensing Satellite) will send an impact probe slamming into the lunar crater Shackleton, in hopes of raising a cloud of debris that will be analyzed for water content.

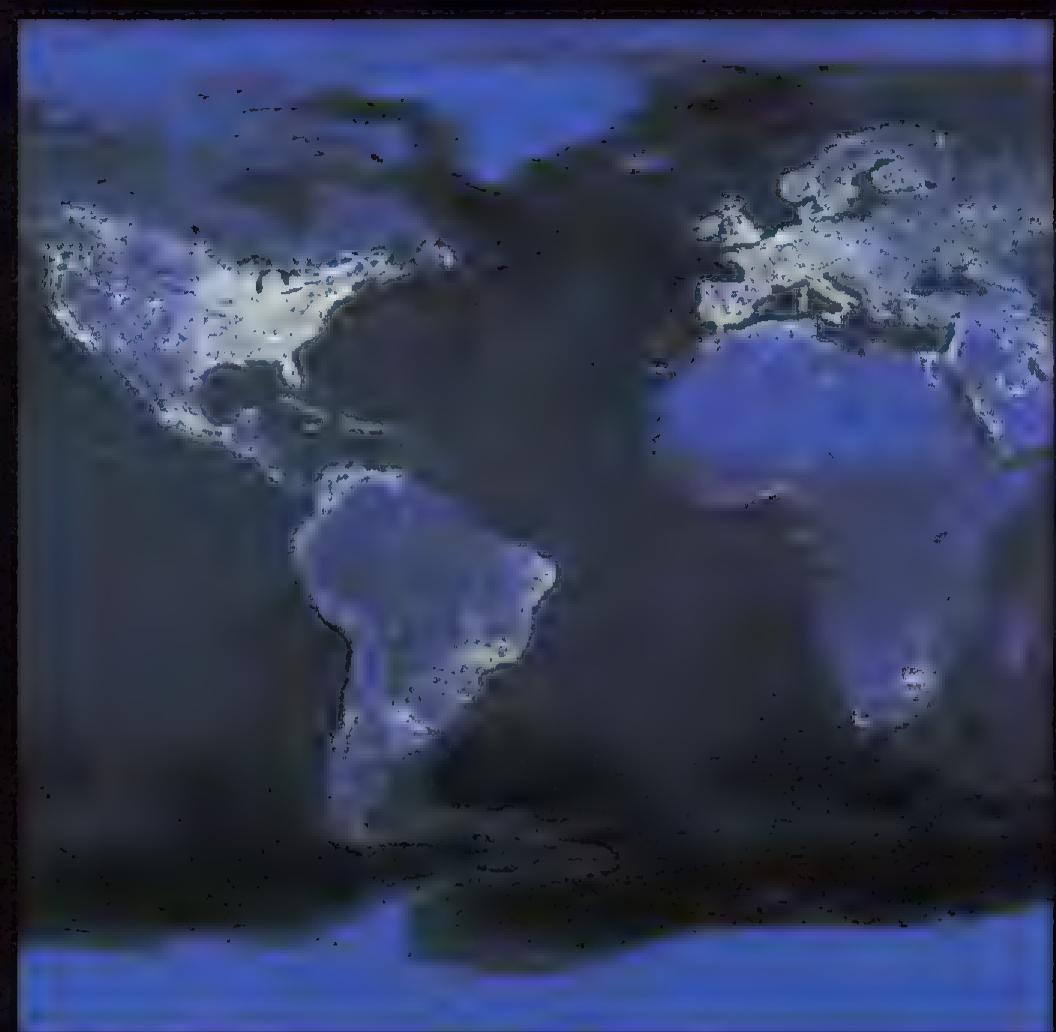
	Sunrise	Local Noon	Sunset
March 1	6:41 am PST	12:22 pm PST	6:04 pm PST
April 1	6:55 am PDT	1:14 pm PDT	7:33 pm PDT
May 1	6:14 am PDT	1:07 pm PDT	8:00 pm PDT

Times are for San Francisco, CA, and will vary slightly for other locations.

Bon Voyage
On March 5, 1979, the *Voyager 1* spacecraft flew past Jupiter. Today it's more than three times the distance to Pluto, currently the most distant manmade object from Earth and speeding away at more than 38,000 miles per hour.

Size Matters
As of this writing, NASA's Kepler spacecraft is scheduled to launch on March 5, 2009, with the goal of surveying 100,000 stars over the next 3½ years in search of planets the size of Earth.

National Dark Sky Week: April 20-26, 2009



Have you ever been camping or on an ocean cruise and looked up at the night sky? About 6,000 stars are visible to the unaided eye, along with the band of the Milky Way and other faint objects. But from the middle of a city, most of those are washed from view by the glow of countless electric lights shining upward. Astronomers call this glow "light pollution," and it's due, for the most part, to inefficiently-designed fixtures that spray light sideways and upward, instead of down to the ground where it's most useful. Light pollution not only prevents people from appreciating the night sky, but it also interferes with astronomers' attempts to analyze light spectra from celestial objects to determine their composition and movement. In an effort to educate the public about light pollution, National Dark Sky Week was started in 2003 to encourage people to turn off unnecessary lights at night and share in the wonder of the night sky.

Easter Bunny in Space

On March 15, the object Makemake ("mah-kay-mah-kay") makes its closest approach to Earth. Joining Pluto in a new category of solar system bodies called "dwarf planets," Makemake is named after the creator of the human race in the mythology of Easter Island. Discovered on March 31, 2005—four days after Easter—it was unofficially dubbed "Easterbunny" by its discoverers. Its Easter Island-inspired name perpetuates, however tenuously, its connection to that holiday. This year, Easter falls on April 12.

Skywatcher's Guide (March - May 2009)

March 8

On the second Sunday of March, most of the United States changes to Daylight Saving Time at 2:00 am and stays there until the first Sunday in November. Most of the country follows Daylight Saving Time for 65% of the year, and clocks tell us that solar noon, when the Sun is highest in the sky, occurs at 1:00 pm instead of 12:00.

March 10

Full Moon. In non-Pacific time zones, it is listed as occurring on March 11. Adjusting for Pacific Time crosses midnight and changes the date. March's full Moon was named the "Moon when Juice Drips from the Trees" by Native Americans of the Delaware tribe, "Flower Time" by the Nez Perce, and the "Tahet (Salmon) Moon" by the Haida.

March 20

Vernal equinox at 4:45 am PDT. By common usage, the start of Spring in the Northern Hemisphere. South of the equator, it's the start of Autumn. The Sun rises due east and sets due west, and day and night are theoretically of equal length.

March 26

New Moon. Watch for the first visible crescent after new very low in the north-northwest at sunset on the evening of the 27th, marking the start of the month Rabi al-Thani in the Moon-based Islamic calendar.

March 29

Last Sunday in March, when countries in the European Union adjust their clocks to Summer Time, equivalent to the U.S.'s Daylight Saving Time.

April 9

Full Moon. By general rule, Easter falls on the Sunday following the first full Moon of Spring and so occurs this year on the 12th. April's full Moon was dubbed the "Egg Moon" by the Algonquin, the "Rains Moon" by the Ponca, and the "Moon to Go Paddling" by the Dakota Sioux.

April 20

Start of National Dark Sky Week, which is observed during the week of April's new Moon.

April 21

Peak of the Lyrid meteor shower after midnight, usually producing 15-20 meteors per hour, although the shower is considered active from the 16th to the 25th. Radiating from the constellation Lyra, which rises in the northeast around 10 pm, Lyrids are swift and occasionally quite bright. With the Moon a waning crescent, conditions are favorable for this display during the midnight-to-predawn hours of the 22nd.

April 24

New Moon. Sighting of the first crescent visible on the evening of the 25th marks the beginning of Jumada al-awwal in the Islamic calendar.

May 2

Astronomy Day, founded in 1973 and designed to share the joy of astronomy with the public. Contact your local amateur astronomy club or science center.

May 6

Peak of the Eta Aquarid meteor shower, which usually produces about 20-60 meteors per hour as dust from Halley's Comet rains through the atmosphere. Typically better seen by Southern Hemisphere skywatchers, this is still a good shower for radio detection. Tune an FM radio to a "dead" spot between stations near the low end of the band, and listen for the momentary effect on transmissions as meteors ionize the atmosphere.

May 8

Full Moon, listed on some calendars as occurring on the 9th. Known as the "Deep Water Moon" by Native Americans of the Kutenai tribe, the "Panther Moon" by the Choctaw, and the "Planting Moon" by the San Ildefonso.

May 20

Winter solstice...on Mars. Expect temperatures as low as -200°F.

May 24

New Moon. Naked-eye sighting of the first visible crescent is possible after sunset on the 25th, marking the start of Jumada al-Thani, the sixth month in the Islamic calendar.

Q&A



Insiders Tell the Best Stories

Teacher professional development is one of the Academy's most powerful tools for cultivating environmental awareness in future generations. And elementary school teachers like Jennie Lee, Namita Ruiz, Heather Wong, and Mira Sinick are helping to plant the seeds of sustainability.

These four women from Lawton Alternative Elementary School in San Francisco will be among 30 local teachers to receive professional development and leadership training through the Academy's new Teacher Institute on Science and Sustainability.

Q: What is Lawton Elementary already doing to help teach sustainability and counteract climate change?

Mira: Lawton hosts an Environmental Week and has compost monitors during lunchtime to help students separate trash from recycling and compost. This year the school will get a new solar panel from PG&E and the San Francisco Department of the Environment.

Q: What are some of the things you're looking forward to about the Institute?

Namita: The Institute is designed to provide us with activities and educational resources that are aligned with science content standards. I look forward to having the tools to give my students a quality "green" education.

Mira: I'm very interested in teaching my students how our trash gets recycled, reused, or buried. By showing them the consequences and costs of each disposal method, I can help them answer questions like: Which is better—using lots of water to wash out plastic paint containers so they can be recycled, or just throwing them away? Using water and paper towels to wash your hands, or hand sanitizer from a container that needs to be recycled?

Q: How does the Institute differ from other science enrichment programs?

Jennie: Using the Academy's wealth of resources, the Institute training will give me more background knowledge in the science I teach, and my confidence and excitement will spread to my students.

Heather: This is the only program that is directly connected to a museum and research institution.

Namita: It's organized so that we can apply what we've learned during the summer to our new classes. And it provides mentorship and assistance throughout the school year, which is an added bonus!

Q: How will your Institute training affect the way you teach science?

Heather: We'll be better able to team-teach across grade levels. A science concept can be introduced in the third grade, then explored in more depth at higher grades.

Namita: Teaching science requires a lot of background information and preparation. Training at the Institute will help me with that. I can apply what I learn right away, and when I get stuck, I can count on the Institute team for help.

Jennie: We need to empower our children and show them they can make a difference in changing the way people think. Maybe our students can be role models for the adults.

The Institute is made possible by a generous grant from the S.D. Bechtel, Jr. Foundation, with additional support provided by JPMorgan, the Patricia Price Peterson Foundation, and Union Bank Foundation (see sidebar). To learn more about the Institute, call (415) 379-5226 or email gsmith@calacademy.org.



Carl A. Ballton

**Senior Vice President of Corporate Social Responsibility at Union Bank
President and Chief Operating Officer, Union Bank Foundation**

From his home base in Los Angeles, Carl A. Ballton oversees charitable contributions and initiatives for Union Bank. The bank's corporate gifts to the Academy include ongoing annual support, a major gift to the recent campaign, and now supporting a pilot program for the Teacher Institute on Science and Sustainability.

Why the Academy is a perfect fit

It's important that corporate America take a leadership role in environmental causes, and the Academy's Institute fits perfectly into our philanthropic objectives of supporting education, the environment, and low- to moderate-income populations.

Walking the walk

Union Bank has hired a chief environmental officer and is looking at its own carbon footprint, exploring ways to become more environmentally friendly. The number of trees used in the grant proposals we receive is astounding, for example, so we're putting our grant application process online.

Most looking forward to when visiting the Academy...

...standing on the living roof, which is such a unique concept. I've also heard a lot about the rainforest, the aquarium, and—of course—the penguins!

To learn more about corporate giving opportunities, please call (415) 379-5409 or visit www.calacademy.org/give.

On the Scene

During special events and members-only hours at the Academy, you never know who or what you may run into.

❶ Young Green Halloween partygoers explore the flooded Amazonian rainforest tunnel in costume.

❷ Blanca Kramer, Anastacia Kramer, Hadley Banas, Hayden Banas, and Jasmine Kim celebrate Halloween among the Academy's exhibits.

❸ Academy members take advantage of a members-only hour to sneak a peek at the rays and sharks cruising through the Lagoon.

❹ Eastwood Associates Hugh and Pat Reynolds talk with Carol Tang (center), the director of the Academy's visitor interpretive programs, during a special preview of the new Academy.

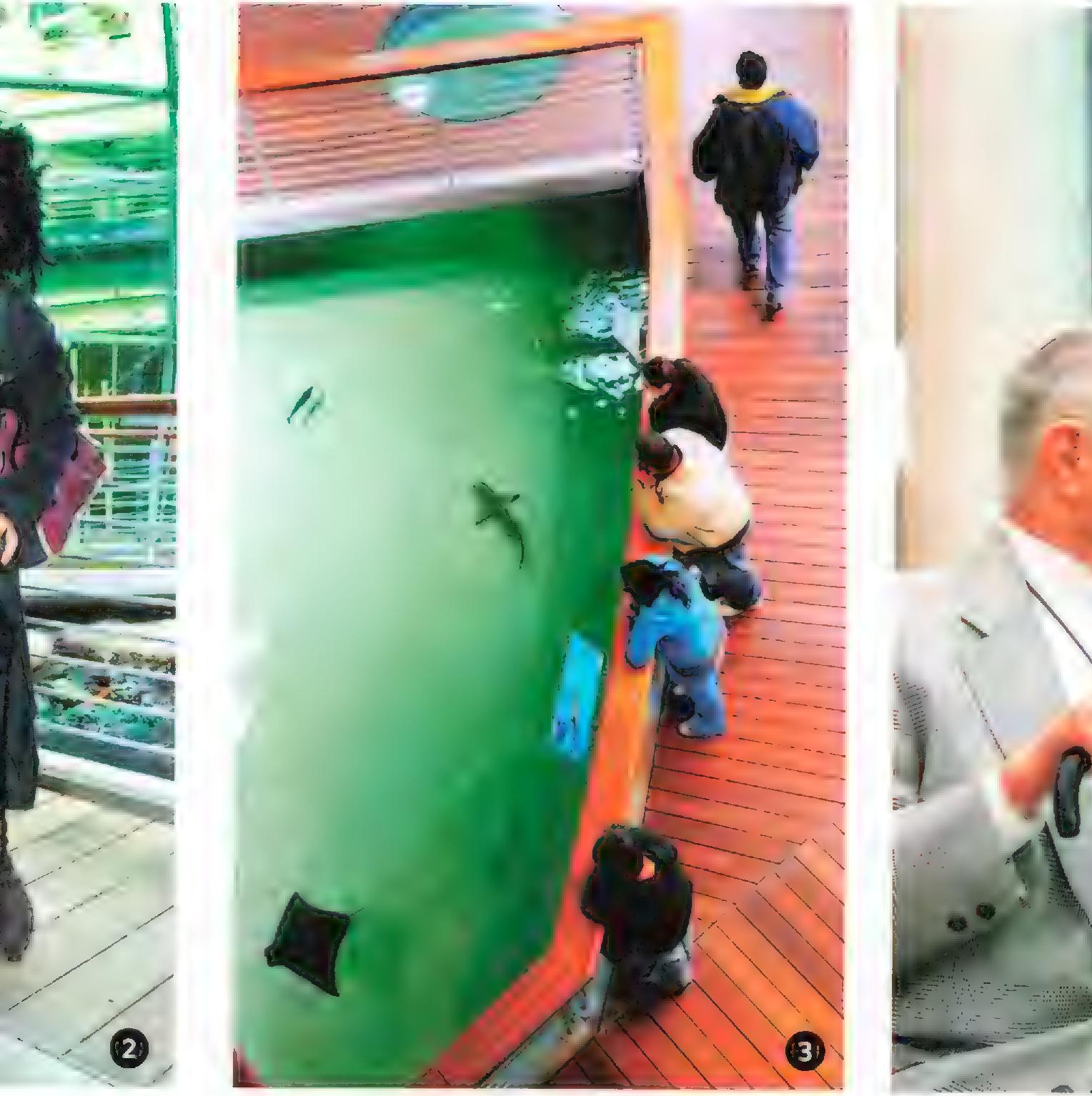
❺ On occasion, members will catch a glimpse of Academy biologists making adjustments to exhibits during members-only hours.

❻ Molly Wadhwani and Vickie Nelson co-chaired the family-friendly Green Halloween celebration on October 24, which raised funds for Academy education programs.

❼ Academy Intern Ebony McGilbra and her family enjoy the annual Careers in Science Family Night Celebration.

❽ 1853 Society members Laura and Mike Patnode check in on the Philippine coral reef during the pre-opening Big Bang Gala.





Get closer to science and the natural world, and be part of an exciting future by deepening your relationship with the Academy. Your increased support gives you added benefits and exclusive access to Academy happenings.

Become a Friend and enjoy exciting new benefits, including exclusive Academy events and private behind-the-scenes experiences. Learn more at www.calacademy.org/join/friends.

The greenest Guild welcomes members with children who want to learn and experience more with their families, and get involved with science in fresh and exciting ways. Learn more at www.calacademy.org/join/guild.php.

Some things do last forever. For an enduring impact, join the Eastwood Associates and make the Academy part of your estate plan. Your legacy commitment to science, discovery, education, and a more sustainable world will shape the future. Learn more at www.calacademy.org/give/planned_giving.php.



The Academy has made every effort to ensure the accuracy of donor lists. Should you find an error, please contact the Development Department at 415.379.5405 or friends@calacademy.org.

Gifts received October 1 through December 31, 2008

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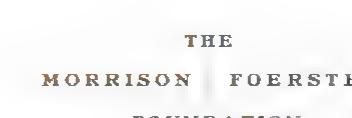
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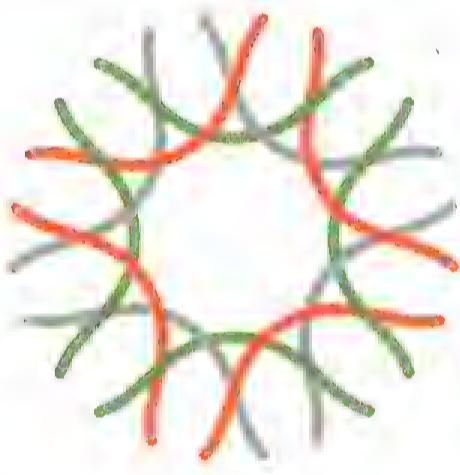


Upside-down Surprise



Photo: Sharon Beals

Steinhart Aquarium biologists recently found a pleasant surprise in the Academy's upside-down jellyfish (*Cassiopea andromeda*) display: dozens of baby jellyfish, about three millimeters in diameter, were pulsating next to the much larger adults. Biologists promptly collected the offspring using an eyedropper and put them in a holding tank, where they will remain until they are large enough for display.

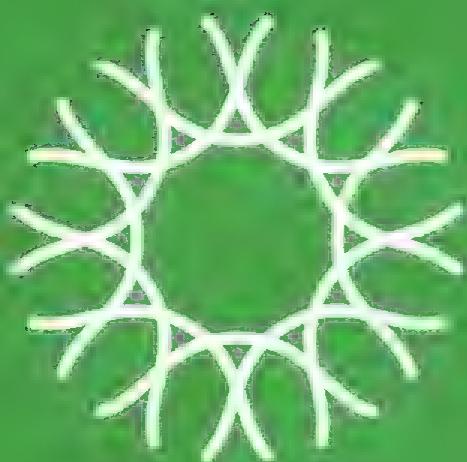


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Live at the Academy

March / April / May
2009



March

Tuesday, 3/3

EVOLVE 2009 Lecture
Darwin and the Heyday
of Natural History

12:15 PM

John Dillon will examine
how Darwin's work was
nurtured by tremendous
public interest in natural
history. See page 12.

Tuesday, 3/10

EVOLVE 2009 Lecture
Collecting Evolution

12:15 PM

Professor Matthew
James will discuss
the importance of
the Academy's 1905-
06 expedition to the
Galapagos. See page 12.

of Darwin's *The Voyage of
the Beagle*. See page 12.

Thursday, 3/12

Home School Day

9:30 AM - 5 PM

Home-schooled chil-
dren and their families
are invited to a day of
fun programs. Space is
limited and reservations
are required. Visit www.calacademy.org/events/homeschool for details
and prices.



Monday, 3/16

Dean Lecture
Iconic Images from the
Hubble

7:30 PM

Dr. Sandra Faber will
tour the Universe with
beautiful images from
the Hubble Space
Telescope. See page 15.

Wednesday, 3/18

Wachovia Wednesday

9:30 AM - 5 PM

The Academy is free to
the public on the third
Wednesday of each
month. Large crowds are
expected; members may
wish to attend on a
different day. Sponsored
by Wachovia.

Thursday, 3/19

DIY DNA Panel

7 PM

In this NightLife
program, speakers from
Wired, 23andMe, and
MyDaughtersDNA.org
will discuss collaborative
research in human
genetics. See page 13.

Saturday, 3/21

TEENS TALK BOOKS
Can You be Both
Scientific and Religious?

11 AM

The first meeting of the
Academy's teen book
group will focus on
Evolution, Me & Other

April

Saturday, 4/4

BioForum: Conservation
Biology

8:30 AM - 4 PM

This seminar for
current science
teachers will examine
the basic principles of
conservation science.

Tuesday, 4/7

BOOKWORMS
Why We Need a Green
Revolution

6:30 PM

This meeting of the
Academy's adult book
group will focus on *Hot,
Flat, and Crowded*. See
page 15.

Wednesday, 4/15

Conversations at the
Herbst

8 PM

Kay Ryan, United States
Poet Laureate. Takes
place at the Herbst
Theatre, 401 Van Ness
Avenue, San Francisco.

Freaks of Nature. See page 12 for details.

Saturday, 3/21

Guild Visit to Spring
6 PM - 8 PM

Guild members are invited to stop by green retailer Spring, in San Francisco, to celebrate the coming of spring and enjoy a green-living conversation with Spring's owner and Guild member Lucas Heldfond. Special offers for Guild members and light refreshments included. RSVP at (415) 379-5404.

Tuesday, 3/24

EVOLVE 2009 Lecture

Darwin, Dover and Intelligent Design

12:15 PM & 6:30 PM

Professor Kevin Padian will discuss his experience as an expert witness for *Kitzmiller v. Dover*, the 2005 trial about intelligent design. See page 12.

Monday, 3/30

Private Reception with Paul Ehrlich

6:30 PM - 7:45 PM

Annual Fund donors at the Curators' Society level and above can enjoy a private catered reception with Ehrlich before his Herbst Theatre talk. Invitations to donors who have contributed \$2,500 or more were mailed in February.



Monday, 3/30

Conversations at the Herbst

8 PM

Paul Ehrlich, the President of Stanford University's Center for Conservation Biology. Takes place at 401 Van Ness Avenue, San Francisco. See page 15.

Drop-in Activities

Check out these hubs of activity, where Academy staff and volunteers are on hand every day to help you dive deeper into the natural world.

Naturalist Center

Over the next few months, stop by the Naturalist Center to see rotating displays of specimens, books, and DVDs that complement the *Islands of Evolution* exhibit, *Altered State: Climate Change in California*, and the living roof. If you would like to continue your explorations at home, sign out some of the Naturalist Center's books, DVDs, or videos. Members can borrow up to five books at a time for three weeks, and two DVDs or videos for one week.

The Naturalist Center also hosts a variety of programs. Schedules are subject to change:

Ask an Astronomer
Every Monday afternoon

Sing-Alongs

Every Saturday at 2:15 pm

Children's Story Time

Every Sunday at 2:15 pm
School-aged children can hear stories and make crafts related to the natural world.

Every Day Is Earth Day

3:00 PM

A demonstration of fun ways to protect the environment in your everyday life.

Monday, 4/20

Conversations at the

Wednesday, 4/22

EARTH DAY 2009

Hands-On Nature

10:30 AM

See page 14 for details.

Every Day is Earth Day

3:00 PM

See page 14.

See page 14 for details.

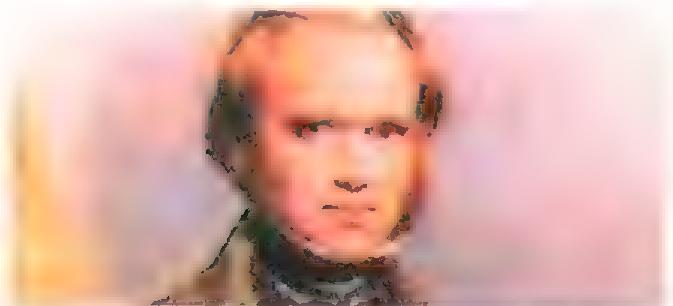
Saturday, 4/4

TEENS TALK BOOKS

Charles and Emma

11 AM

This meeting of the Academy's teen book group will focus on *Charles and Emma: The Darwins' Leap of Faith*. See page 12 for details.



Monday, 4/6

Dean Lecture

Habitable Worlds in the Universe

7:30 PM

Geoff Marcy will discuss the searches for Earth-like worlds around other stars. See page 15 for details.

See page 14 for details.



Tuesday, 4/14

EVOLVE 2009 Lecture

Discovering Hominid Fossil Remains

12:15 PM & 6:30 PM

Academy curator Zeray Alemseged will discuss recent discoveries related to hominid fossil remains. See page 12 for details.

Wednesday, 4/15

Wachovia Wednesday

9:30 AM - 5 PM

The Academy is free on the third Wednesday of each month.

See page 15.

Saturday - Sunday, 4/18 - 4/19

EARTH DAY 2009

Sustainability Fair

Talk to eco-friendly partner organizations. See page 14 for details.

Explore Golden Gate

Park with a Naturalist

10 AM - 12 NOON

Take a walk in Golden Gate Park and learn about the Academy's wild neighbors. See page 14 for details.

Hands-On Nature

10:30 AM

Enjoy a hands-on, family activity that inspires an appreciation for the natural world.

May



Monday, 5/4

Dean Lecture

Are We Alone?

7:30 PM

Jill Tarter will summarize the exploration for extraterrestrial intelligence. See page 15.

Saturday, 5/9

Guild Spring Picnic

11:30 AM - 2 PM

The Shakespeare Garden beside the Academy will come alive with young scientists-in-training during the Guild Spring Picnic. Bring a waste-free lunch and join other Guild families, create nature-inspired crafts, and learn how to identify plants in the garden. Call (415) 379-5404 for details.

Friday, 5/15

1853 Society Open House

6:30 PM - 9 PM

The 1853 Society of Annual Fund donors can explore the entire Academy during this open house. Throughout the evening, Academy scientists will showcase new and surprising features of their special collections. Call (415) 379-5819 to learn more about the distinguished 1853 Society.

Herbst

8 PM

Artist and sculptor Maya Lin. Takes place at 401 Van Ness Avenue, San Francisco. See page 15.

Tuesday, 4/21

Collector's Society Dinner

Collectors' Society annual donors and above are invited to an intimate dinner and presentation at the Academy. For details or to upgrade your support to the Collectors' Society, call (415) 379-5413 or email jyoo@calacademy.org.



Saturday - Sunday,

4/25-4/26

EARTH DAY 2009

Explore Golden Gate Park with a Naturalist

10 AM - 12 NOON

See page 14 for details.

Hands-On Nature

10:30 AM

See page 14.

Every Day Is Earth Day

3:00 PM

See page 14.

Tuesday, 4/28

EARTH DAY 2009

Living with Wolves

7:00 PM

Join Jim and Jamie Dutcher for a film and presentation about their experiences living among gray wolves at the edge of Idaho's Sawtooth Wilderness. See page 14.

Tuesday, 5/19

Leakey Lecture

Darwin and the Descent of the Emotionally Modern Man

7 PM

Academy Fellow Sarah Hrdy will discuss the evolution of emotionally modern humans, which occurred perhaps as early as 1.8 million years ago. See page 12.

Wednesday, 5/20

Wachovia Wednesday

9:30 AM - 5 PM

The Academy is free to the public on the third Wednesday of each month.

Tuesday, 5/26

Conversations at the Herbst

8 PM

James Hansen, Head of the NASA Goddard Institute for Space Studies. Takes place at 401 Van Ness Avenue, San Francisco. See page 15.

Early Explorers Cove

Take your scientist-in-training to a special exhibit designed especially for children five and under and their caregivers. Tots can explore a 15-foot replica of the Academy's 1905 research schooner, climb into a tree-house, tend a miniature organic garden, or crawl into a child-sized burrow. The exhibit is also well-stocked with books, toys, puzzles, and dress-up costumes. Explorers Cove Story Time takes place every Saturday at 11:00 am.

Monday, Wednesday-Sunday: 10 AM - 5 PM

Tuesday: 8:30 AM - 5 PM

Children may not be left unattended; space will be filled on a first-come, first-served basis.

Exclusive Member Benefits

Members-Only Hours

Beat the crowds, and visit the new Academy during special members-only hours, every Tuesday from 8:30 - 9:30 AM and Sunday from 10 - 11 AM.

Store Discount

Present your Academy membership card to receive a 10% discount in the Academy stores.

Every week at the Academy!

Monday

10 AM - 4 PM*	Bugs!
10:30 AM	Penguin Feeding
11:30 AM	Coral Reef Dive
11:30 AM - 4:30 PM**	Fragile Planet
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding

Friday

10 AM - 4 PM*	Bugs!
10:30 AM - 4:30 PM**	Fragile Planet
10:30 AM	Penguin Feeding
11:30 AM	Coral Reef Dive
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding

Tuesday

10 AM - 4 PM*	Bugs!
10:30 AM - 4:30 PM**	Fragile Planet
10:30 AM	Penguin Feeding
11:30 AM	Coral Reef Dive
1 PM	Swamp Talk
1:30 PM	Lagoon Feeding
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding

Saturday

10 AM - 4 PM*	Bugs!
10:30 AM - 4:30 PM**	Fragile Planet
10:30 AM	Penguin Feeding
11:00 AM	Swamp Talk
11:30 AM	Coral Reef Dive
12:30 PM & 1:30 PM	Penguin Show-n-tell
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:00 PM	Swamp Talk
3:30 PM	Penguin Feeding

Wednesday

10 AM - 4 PM*	Bugs!
10:30 AM	Penguin Feeding
11:30 AM	Coral Reef Dive
11:30 AM - 4:30 PM**	Fragile Planet
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding

Sunday

10:30 AM / Members Only	Fragile Planet
10:30 AM / Members Only	Penguin Feeding
11 AM / Members Only	Bugs!
11:00 AM	Swamp Talk
11:30 AM	Coral Reef Dive
11:30 AM - 4:30 PM**	Fragile Planet
12 noon - 4 PM*	Bugs!
12:30 PM & 1:30 PM	Penguin Show-n-tell
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:00 PM	Swamp Talk
3:30 PM	Penguin Feeding

Thursday

10 AM - 4 PM*	Bugs!
10:30 AM	Penguin Feeding
11:30 AM	Coral Reef Dive
11:30 AM - 4:30 PM**	Fragile Planet
1 PM	Swamp Talk
1:30 PM	Lagoon Feeding
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding
6 PM - 10 PM	NightLife

*Every hour on the hour

**Every hour on the half-hour

Featured Attractions

These regularly scheduled programs take place every week at the museum. Check the calendar section in this guide for information about additional special events.

Penguin Feeding

Location: African Hall

The Academy's African penguins are always especially animated during meal time. Watch the birds dip and dive in their new tank at the end of African Hall as a biologist dons a wetsuit and hands out vitamin-stuffed herring and capelin. Each feeding takes 20 minutes, and questions are encouraged.

Daily: 10:30 AM and 3:30 PM

Coral Reef Dive

Location: Philippine Coral Reef (Lower Level)

Watch as a diver suits up in SCUBA gear and plunges into the world's deepest living coral reef exhibit. Outfitted with an underwater microphone, the diver will answer all of your reef-related questions and explain why coral reefs are among the most important—and endangered—ecosystems in the world.

Daily at 11:30 AM and 2:30 PM

Bugs!

Location: Hearst Forum

3D Theater

A remarkable foray into the fascinating world of insects, this 25-minute feature was filmed on location in the tropical forests of Borneo. Using immersive 3D technology, the film follows the life cycles of Hierodula, the praying mantis, and Papilio, the butterfly. Slide on your special viewing glasses and see for yourself what all the buzz is about.

Monday-Saturday: Every hour on the hour from 10 AM – 4 PM

Sunday: Every hour on the hour from 11 AM – 4 PM

Note: The 11 AM show on Sunday is offered exclusively for members.

Swamp Talk

Location: Swamp (L1)

Join us at the Swamp to learn about some of the Academy's most popular animals, including the albino alligator and the alligator snapping turtles. You'll find out what it takes to care for these amazing creatures, which are native to swamps in the southeastern United States.

Daily at 1 PM

Fragile Planet

Location: Morrison

Planetarium

Leave Planet Earth behind as you fly to the farthest reaches of the Universe in this 30-minute show. Begin your voyage at the Academy, lift off through the atmosphere to gain an astronaut's view of Earth, then travel to the Moon, Mars, and beyond to search for habitats that might host life.

Monday, Wednesday

& Thursday:

Every hour on the half-hour from 11:30 AM – 4:30 PM

Tuesday, Friday-Sunday: Every hour on the half-hour from 10:30 AM – 4:30 PM

Note: The 10:30 AM show on Sunday is offered exclusively for members. Seats are limited and first-come, first-served.

NightLife

Gaze into the stars, get up close and personal with aquarium critters, explore art with a scientific edge, and much more during the Academy's weekly NightLife events. Tickets cost \$8 for members, \$10 non-members. NightLife is for patrons ages 21 and over; a valid ID is required for entry.

Every Thursday from 6 – 10 PM

